REPORT
OF
HARBOR AND LAND COMMISSIONERS

1902

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ANNUAL REPORT

OF THE

BOARD OF HARBOR AND LAND COMMISSIONERS.

FOR THE YEAR 1902.

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Commonwealth of Massachusetts.

REPORT.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, pursuant to the provisions of law, respectfully submits its annual report for the year 1902, covering a period of twelve months, from Nov. 30, 1901.

From Dec. 1, 1901, to Nov. 30, 1902, the Board has held 225 meetings, has given 311 formal and informal hearings, and has received 188 petitions for license to build and maintain structures and for privileges in tide waters and great ponds, to dredge material, to remove material from beaches, and for other purposes.

One hundred and twenty-eight licenses for structures and privileges in tide waters and great ponds have been granted during the year; also 18 permits for dredging, for the removal of material from beaches, and for other purposes.

Seventy-one inspections have been made by the Board at various times of work completed and in progress, under appropriations made by the Legislature, in Boston harbor, the Reserved Channel and the Commonwealth flats at South Boston, South Bay, location of dredging off the southerly shore of South Boston, the Province Lands in Provincetown, protective works on Connecticut River at Hadley, Herring River at West Harwich, East and West bays at Osterville, jetties at Bass River, Scorton harbor, jetties at Menamsha Inlet, breakwater at Apponagansett harbor, sea wall at

North Scituate, sea wall and jetties at Stony Beach in Hull, work in progress at Lake Anthony in Cottage City, Cataumet harbor, survey work at Mt. Tom and Mt. Nonotuck, Merrimac River relative to determining the advisability of opening the river to navigation, New Bedford and Fairhaven bridge; also of the sites of proposed work in tide water and great ponds upon petitions and plans presented to the Board, the location of wrecks and obstructions to navigation, and various structures built under licenses from the Board.

Through transactions of the Board there has been paid into the treasury of the Commonwealth during the past year, from rents, licenses, sales of land and other sources, and credited to the Commonwealth's flats improvement fund and the harbor compensation fund for Boston harbor, the aggregate sum of $1,051,568.38.

During the year 18 new contracts * were made by the Board, duly authorized for the estimated expenditure of $661,438.80.

Commonwealth Tide Lands.

The Governor and Council, under the provisions of section 24 of chapter 96 of the Revised Laws, determined that the compensation for the rights granted in land of the Commonwealth, to be filled or otherwise occupied under the following licenses granted by the Board, should be as stated below: —

No. 2614, granted April 25, to the Fall River Iron Works Company, to build a sea wall and fill solid on Taunton River, in Fall River, $200.

No. 2642, granted July 17, to William F. Nye, to extend his wharf at Fish Island in New Bedford harbor, $50.

No. 2663, granted October 10, to the New England Cotton Yarn Company, to build a bulkhead, drive piles, fill solid and erect a building on Acushnet River, in New Bedford, $100.

No. 2665, granted October 31, to the city of Boston, to repair and build an addition to its wharf on the easterly side of Long Island in Boston harbor, $30.24.

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* See Appendix A.

Boston Harbor.

The citizens of the Commonwealth will never fail to maintain a lively interest in the harbor of Boston. Its natural advantages invited early settlement on its shores, and to-day its improved water ways and accommodations lay claim to a fair share of the commerce of the country with foreign ports.

For years it has ranked as the port of second importance in its tonnage of exports and imports, and during that time has averaged over nine per cent. of the total import and export values of the whole United States. Up to 1895 its customs duties on imports amounted to $570,086,708, out of a total for the country of $5,819,231,013.

During the same time the appropriations by Congress for improvement in all the harbors of the Commonwealth have been less than two and one-half per cent. of the total appropriations for the entire country.

Meantime, the Commonwealth, by its Board of Harbor and Land Commissioners, has since 1874 expended the sum of $1,699,481.14 in improving the navigable conditions in the harbor by dredging at the following places: Junction Shoal, Bird Island Shoal, Fort Point Channel, Reserved Channel, Winthrop Channel, off East Boston, South Bay, Chelsea Creek, Shirley Gut, and Charles, Mystic and Neponset rivers, besides deepening the main ship channel of the upper harbor.

The Legislatures of 1901 and 1902 made a still further appropriation of over $1,100,000 for improving the anchorage accommodations alone, which is now being expended.

In addition to the expenditures by the Commonwealth, the federal government has spent in the neighborhood of $3,000,000 for improvements of the harbor, and has matured projects for which a yet larger sum has been appropriated. The United States project of 1892 contemplated widening the channel between the outer light and East Boston south ferry to 1,000 feet, and deepening it to 27 feet at mean low water, at a cost of nearly $1,500,000. The strictly dredging part of this has been accomplished,

although a considerable quantity of rock is yet to be removed.

The project of 1899 proposed a new outlet channel from President Roads through Broad Sound, to be 30 feet deep at mean low water and 1,200 feet wide. This is nearly completed.

The project of 1902 involves dredging the channel 35 feet deep at mean low water, from the Charles River and Chelsea bridges and the Navy Yard, 1,200 feet wide, to President Roads, and thence through Broad Sound, 1,500 feet wide, to the sea, at an estimated cost of about $8,000,000, of which $3,600,000 has been appropriated for expenditure under the continuing contract system. Contracts for this work are about being made.

When these projects are completed, Boston harbor will have three distinct entrance channels, — one 35 feet deep and 1,500 feet wide and another 30 feet deep and 1,200 feet wide, both through Broad Sound, and one 27 feet deep and 1,000 feet wide, known as the main ship channel, through the Narrows. When the mean rise of tide, 9.8 feet, is added to these depths, it will be seen that at high tide there will be water enough to navigate any steamship now afloat at her loaded draught. In fact, the deepest of them could come in or go out at half tide with safety.

It is encouraging to realize that the port of Boston, although still awaiting further improvements, is not less prepared than other great ports, both here and abroad, for the floating of modern steamships. Not only is New York having its harbor channels widened and deepened, and Liverpool having new docks built with lower gate sills, but London has been awakened by loss of trade to the necessity of overhauling its dock system and deepening the channels of the Thames.

At London, with its population of 6,000,000 in 1899, goods were imported of the valuation in round numbers of £164,000,000, or about $820,000,000. Nevertheless, the falling off in the *entrepot* trade led to the appointment of a Parliamentary Commission on the Port of London, which reported in favor of dredging a channel 36 miles long from the

Nore to the Royal Albert Dock, to be 30 feet deep at low tide, and 1,000 feet wide for a distance of 29 miles and 600 feet for the balance; thence about 9 miles to the London docks, 25 feet deep, at a cost, including the completion of certain river accommodation work, of £2,500,000, or about $12,500,000. Then the docks must be purchased and put into condition and fitted for modern needs, at a cost of £24,500,000, or about $122,500,000, making a total, to fit the port of London to do a successful and competing business at the present day, of £27,000,000, or about $135,000,000.

Liverpool, in addition to $200,000,000 already expended on its system of docks, is spending yet more in dredging and increasing its dockage accommodation for twentieth-century ships.

Bristol, Eng., is another port aroused to the requirements of the day and, with a population of only 318,000, recently procured an act of Parliament to permit the expenditure of the large sum of $13,875,000 for the improvement of the port at Avonmouth, in order to provide twentieth-century accommodations to steamships. These projects are perfected and the work well advanced. Already these increased facilities are attracting attention, and a new line between Bristol and Boston is under negotiation.

As compared with the sums spent on harbors abroad, such as $200,000,000 at Liverpool, $74,000,000 at Glasgow, $39,000,000 at Hamburg, $28,000,000 at Havre, $26,500,000 at the Tyne ports, $26,000,000 at Rotterdam, $25,000,000 at Antwerp, $23,000,000 at Marseilles, $13,800,000 at Melbourne and $11,400,000 at Bombay, the amounts so far expended for the improvement of the port of Boston do not seem large.

When all the present projects shall be completed, the harbor of Boston, in point of approach, entrance, protection, depth, area, anchorage, convenience and port charges, will compare favorably with any of those above named.

Anchorage.

By chapter 476 of the Acts of 1901, the Board was authorized to provide additional anchorage ground in Boston harbor, northerly of the main ship channel, in substantial accordance with the project prepared by the Board and described in its report to the Legislature for the year 1900. Section 3 of the act required the Board to obtain from the owners of Bird Island Shoal a release of all their right, title and interest therein, without expense to the Commonwealth.

A release dated Nov. 11, 1901, was received from the only known owner, the city of Boston. For the purpose, however, of confirming the title in the Commonwealth, a petition was filed by the Attorney-General with the Court of Land Registration, and on April 24, 1902, a decree of confirmation of the title was entered.

The Board at once proceeded to prepare the necessary plans and specifications, and, with a view to carrying on the work economically and expeditiously, divided the total area lying along the northerly side of the main ship channel, and covering about 1 mile in length and 1,000 feet in width, into four sections, each to be excavated to a depth of 30 feet at mean low water.

Proposals for dredging these four sections were received June 26, 1902, and on the same date a contract for Section 1 was entered into with the New England Dredging Company and the Eastern Dredging Company, jointly, the lowest bidder. The estimated amount of dredging in this section is about 646,500 cubic yards, measured in situ, the area to be dredged containing about 1,505,000 square feet, and the contract price for each cubic yard dredged and deposited at sea being 16 3/10 cents. Further terms of this contract were modified by agreement dated Oct. 27, 1902, approved by the Governor and Council October 29, and provide for the deposit of acceptable material dredged from other parts of the harbor in substitution for that taken from the anchorage ground, to an amount not exceeding 300,000 cubic yards, on the easterly portion of the Commonwealth flats at South Boston, within an area of about 25 acres, partially enclosed by a bulkhead

and sea wall, now being filled for improvement. For rehandling and grading the material required to fill this area on the Commonwealth flats, which in the opinion of the engineer of the Board cannot be deposited directly from hopper-bottom scows, the price of 18 9/10 cents per cubic yard, measured in the fill, is to be paid.

Contracts for the remaining three sections were entered into with Geo. H. Breymann & Bros., the lowest bidder, on June 26, 1902, details of the contracts being as follows: —

Section 2, estimated amount of dredging, about 651,600 cubic yards; area to be dredged, about 1,200,000 square feet; contract price, 15 cents for each cubic yard dredged and deposited at sea, measured in scows.

Section 3, estimated amount of dredging, about 646,700 cubic yards; area to be dredged, about 1,150,000 square feet; contract price, 15½ cents for each cubic yard dredged and deposited at sea, measured in scows.

Section 4, estimated amount of dredging, about 654,300 cubic yards; area to be dredged, about 1,630,000 square feet; contract price, 16 cents for each cubic yard dredged and deposited at sea, measured in scows.

The differences in the contract prices are to be accounted for in the variation of physical conditions under each contract and the distributive requirements of the contract relating to Section 1.

All of the work in the four sections is to be completed not later than July 1, 1904.

The amount of material excavated from each section, up to Dec. 1, 1902, is as follows: —

	Cu. Yds.
Section 1,	170,654
Section 2,	111,515
Section 3,	15,326
Section 4,	13,805
Total,	311,300

The construction of the pile piers for mooring vessels and the solid filling on Bird Island Shoal will not be commenced until the dredging of the area nearest the ship channel has been nearly completed.

Dredging in Boston Upper Harbor.

Pending the completion of the projects of the federal government, the Board became satisfied of the necessity of enlarging some of the channels in the upper harbor, in order to enable the deep draught steamships of the present day to conveniently reach their docks.

In 1900 a channel was dredged by the Commonwealth through the bar at the confluence of Charles and Mystic rivers, 250 feet wide and 25 feet deep at mean low water. Since that time another and larger dock has been built between the Hoosac Tunnel piers and the Navy Yard, and the size and draught of the steamers docking there has increased.

Naturally, the channel proved inadequate. Accordingly, on April 14, 1902, a contract, for the purpose of enlarging the existing channel, was entered into with the New England Dredging Company, the lowest bidder, to dredge an area at the mouth of Charles River, extending from a point opposite the south-westerly corner of Pier No. 6 of the Hoosac Tunnel docks down past Fiske's wharf to a point opposite the north corner of Battery wharf, to a depth of not less than 27 feet at mean low water; the object being to continue the 27 foot channel dredged by the federal government from the point at which its work under the project of 1892 ceased, up to the docks. This contract, calling for an expenditure of about $29,000, is to be paid for out of the income of the harbor compensation fund, at the rate of 29½ cents for each cubic yard of material, measured in scows. The work was at once commenced, but proceeded more slowly than was anticipated, owing to accidents and the heavy character of the material dredged. Up to Dec. 1, 1902, 94,445 cubic yards have been excavated, leaving a small ridge to be removed before the undertaking will be completed.

In October, 1901, petitions were received from the owners of Union and Lincoln wharves, asking that a portion of the harbor be excavated to a depth sufficient to enable steamers to enter the new berths then being dredged at their wharves. After an examination of the premises it was decided to

dredge to the depth of 23 feet at mean low water the whole distance from Lewis wharf to the North Ferry, and in breadth from the ship channel to a line 50 feet outside of the harbor line, thus lowering the bottom of the fairway to a uniform depth, throughout this section, of not less than 23 feet, and giving ample depth for coastwise vessels. The neighboring areas had previously been dredged.

A contract for this work was entered into with the New England Dredging Company, the lowest bidder, under date of Nov. 22, 1901, at the rate of 32⅞ cents per cubic yard, measured in scows, and was completed Jan. 6, 1902, 15,093 cubic yards having been excavated at a cost of $4,217.53.

Dry Dock.

The inadequacy of the present dry dock accommodation at this port is a matter of common knowledge. The usefulness of the new dry dock at the Charlestown Navy Yard for merchant vessels will be wholly contingent upon whether or not it may be occupied or needed for war vessels, the growing number of which renders the chance for merchant vessels a constantly decreasing quantity.

It may be safely said that no leading port abroad is so deficient in this respect as Boston, as, for instance, at Liverpool there are 24 dry or graving docks, at Antwerp 10, at Southampton 5 or more, one of which is 750 feet long; the largest, 925½ feet long, is at Liverpool. It would be unfortunate if, after the other requirements of a first-class port had been complied with, opportunity for docking in case of needed repairs should be found lacking. Economical reasons for making repairs on the other side of the Atlantic are diminishing, and when the time comes that repairs can be made as cheaply and advantageously at this port as elsewhere, a new and valuable industry offers itself for encouragement.

Lights at Broad Sound Channel and State Ledge.

On January 29 the following letter from the Board was sent to the committee on interstate and foreign commerce of the House of Representatives at Washington, in regard to

the establishment of a lighthouse and fog signal station on State Ledge in Boston harbor: —

JAN. 29, 1902.

To the Honorable Committee on Interstate and Foreign Commerce, of the House of Representatives, Washington, D. C.

GENTLEMEN: — The Board of Harbor and Land Commissioners of the Commonwealth of Massachusetts desires to impress upon your honorable committee the great urgency for a lighthouse and fog signal station on State Ledge in Boston harbor.

State Ledge is located midway down the harbor, a short distance from Castle Island, just before entering President Roads. Its position is such as to require a change in the course or direction of vessels navigating the lower middle channel.

In March, 1895, the "Venetian," an iron freight steamer plying between Boston and Liverpool, was wrecked on this ledge on her way out. The federal government declined to remove her, on the ground that she was on the edge of the channel and not in the channel, claiming that the pilots of the port preferred her to remain, because she answered the purpose of a lighthouse. Navigators could see her looming in the night or the fog, when they could not find the buoy which marked the ledge on which she rested. Other wrecks have also marked the spot for a time, as a peril to navigation.

I believe there never has been a dissent on the bart of any of the United States officers stationed at this port from the proposition that the channel should be marked by a lighthouse on State Ledge.

The greater the commerce of the port, — which has been doubled in a quarter of a century, and last year amounted to $197,005,118, — the greater is the need for this proposed lighthouse.

An inspection of the locality alone would lead to a conviction of the necessity for this light, and render argument in opposition to it futile.

For the Board, WOODWARD EMERY,
Chairman.

Delegations of merchants also visited Washington and urged the necessity for this lighthouse. The estimate of appropriations sent to Congress at its present sitting by the Secretary of the Treasury includes the sum of $52,000 for light and fog signal stations at State Ledge.

On March 6 the Board, having been apprised that a bill

providing for marking the entrance to Broad Sound Channel, Boston harbor, had, through the efforts of Senator Lodge, at the request of this Board, passed the Senate, sent the following letter to each of the Representatives in Congress from Massachusetts : —

March 6, 1902.

Dear Sir : — A lighthouse bill has just passed the Senate, providing for marking the entrance to Broad Sound Channel in Boston harbor with a lighthouse on the Graves and other range lights. As Broad Sound Channel will be completed this summer, it is very desirable that this appropriation should go through as early as possible, in order that the channel may be made available for navigation.

We ask your earnest effort in this behalf.

Yours respectfully, Woodward Emery,
Chairman.

This bill became a law.

On July 8 a communication was received from Lieutenant-Colonel Stanton, engineer of the second lighthouse district, requesting the Board to convey to the United States the title of the Commonwealth to a tract of land covered by navigable waters of Massachusetts Bay at the north-east Grave at the entrance to Boston harbor, for the purpose of erecting a light and fog signal station. A deed was immediately executed by the Board under the provisions of section 8 of chapter 1 of the Revised Laws, and approved by the Governor and Council.

Winthrop Channel.

On May 22 a petition was received from the Boston Chamber of Commerce and others, calling attention to the necessity of immediate relief by dredging Winthrop Channel to its original required depth of 8 feet at mean low water. The Board also gave a hearing to the Winthrop Yacht Club and others on this subject. As no funds were available for this work, the relief asked for could not be given.

Early in July notice was received from the officers of the Winthrop Steamboat Company that there were certain rocks in the portion of the dredged channel leading to the wharves

at Winthrop, nearly opposite Snake Island, which the propellers of its steamers had struck. The Board caused examinations of the channel to be made at three different times, when officers of the steamers were present, but was unable to find any trace of rocks in the localities pointed out by the officers, or elsewhere.

Shirley Gut.

A survey of Shirley Gut was made early in May, when it was found that during the winter considerable quantities of gravel had been driven along the beach and deposited at the point within the area which had been dredged the previous year, thereby narrowing the channel. The northerly portion of the area which had been dredged has apparently not been affected. In granting permits for taking gravel from this locality, the material being used in building operations, an arrangement was made with the Eastern Dredging Company to remove without expense to the Commonwealth the material which had drifted into the channel during the winter from the area northerly of the metropolitan sewer, and with the Bay State Dredging Company from the area southerly of the metropolitan sewer, thus restoring the channel to the same condition as in 1901. This was done before the boats of the Clyde line began their trips to Nahant. It will probably be necessary to do some dredging in this locality each year, to remove material which is driven in by the sea during the winter. In dredging for gravel at this place a large part of the bar or spit which made out from the north-westerly point of Deer Island has been removed, and if the demand for gravel continues another year, a channel will undoubtedly be excavated through this bar, thus making the passage through the Gut less crooked and more easily navigated.

Dorchester Bay.

By chapter 425 of the Acts of 1902, the Board was directed to dredge an area in Dorchester Bay, off the southerly shore of South Boston, to a depth of not more than 12 feet at mean low water, at an expense not exceeding $100,000, to be ac-

complished during the four years, 1902 to 1905, — the object being to provide an area within which yachts anchoring in this locality could lie afloat at all stages of the tide, and also to give approaches to the yacht landings along the city parkway.

As dredging done in various places had destroyed the value of the survey of this area, a re-survey became necessary, and was made during June and July. Subsequently, representatives of the various yachting associations and others interested were invited to a conference with the Board. As an outcome of the opinions expressed, it was finally determined that the best results could be obtained by dredging two basins, the larger one with an area of about 56 acres extending easterly a distance of about half a mile from the line of O Street, the smaller one with an area of about 9½ acres and located opposite the block between K and L streets. The larger basin will have a depth of 9 feet at mean low water to accommodate the large yachts frequenting the public landing and the yacht clubs in its vicinity; the smaller basin will have a depth of 6 feet at mean low water to accommodate the small yachts and those making a landing at the Mosquito Fleet Yacht Club.

Proposals for this work were received on October 9, but the Board, deeming the prices too high, rejected all the proposals, and on October 29 entered into a contract with the New England Dredging Company and the Eastern Dredging Company, jointly, at a lower rate of 21 cents per cubic yard.

Work was commenced November 5, and up to Dec. 1, 1902, 11,212 cubic yards of material have been excavated, a portion of the same being taken to sea and a portion used in filling the Commonwealth flats on the northerly side of South Boston.

Hull.

By chapter 483 of the Acts of 1901, an appropriation of $10,000 was made for the building of sea walls or other structures along Stony Beach, in Hull. This act was approved June 10, 1901, but did not take effect until accepted by the town of Hull by a vote on Sept. 12, 1901, too late

in the season to begin the work. Surveys were made and plans and specifications prepared, and, as the wall and jetties were to be built on private land, a taking was made on March 7, 1902, of the right and easement to enter upon this land, and build, maintain and repair the wall and jetties.

On March 25, 1902, a contract was entered into with Lawler Bros., the lowest bidder, to build 1,431 feet of concrete sea wall, for the sum of $4.90 per lineal foot of wall 8 feet high, and $3.50 per lineal foot of wall 6 feet high, and 720 feet of spur jetties of the same material, for the sum of $2.50 per lineal foot, on the outer slope of Stony Beach between Point Allerton and the point where the New York, New Haven & Hartford Railroad crosses the highway just east of Stony Beach station. This work was completed July 30, 1902, at an expense, including supervision and contingencies, of $8,352.85, or $3.88 + per lineal foot.

The Commonwealth Flats at South Boston.

In May, 1898, during the progress of the extension and elevation of Summer Street over the freight yards of the New England Railroad Company and across the property of the Commonwealth, the Board opened negotiations with the New York, New Haven & Hartford Railroad Company, with a view to selling it land east of B Street, for the purpose of increasing the area of its freight yard at South Boston. These negotiations continued in a somewhat intermittent way until last spring, when an arrangement was finally consummated for the conveyance of land lying between B Street on the west, C Street on the east, Fargo Street on the north and Anchor Street on the south, for the sum of $1,000,000.

There are two ways of valuing this sale: one from the Commonwealth point of view, which is taking the area of the six lots sold outside of the streets, as indicated on "Plan of South Boston Flats, December, 1896," amounting to 685,629 square feet, and dividing the purchase money by the area. This yields $1.46 per square foot for the land sold within the lot areas, besides saving the cost of preparing the cross streets for travel and use by prospective purchasers in case the lots were cut up and sold in parcels bounding

thereon. The other would be the point of view of the purchaser, and that is, to divide the price paid by the total number of feet of land acquired, which would include not only the area of the six lots aforesaid, but also the areas of the streets. By this method of computation the price per foot would be somewhat reduced. Doubtless these different points of view enabled the parties to come together.

Before consummating the foregoing transaction, it became necessary to have legislative action for the purpose of discontinuing B Street, — a public way heretofore laid out and lying between the yard of the New England Railroad Company and the property sold, — and laying out C Street parallel thereto; and provision therefor was made by chapter 377 of the Acts of 1902.

The sale of this land is of advantage to the Commonwealth in replenishing the fund from which the cost of the improved anchorage basin in Boston harbor is to be defrayed, and will be of value to the public by increasing the freight-distributing accommodations of the railroad company lying within 1¼ miles of State Street.

On March 4, 1902, the Board executed a deed from the Commonwealth to Philip H. Butler of 10,500 square feet of land on the Commonwealth flats, bounded by Anchor and B streets, the consideration being $6,300. This deed was given in accordance with the provisions of a bond from the Commonwealth to the said Butler, dated March 7, 1899.

On May 7, the Board executed a deed from the Commonwealth to James Richard Carter, William B. Rice and Andrew G. Webster, trustees, of two parcels of land on the Commonwealth flats, containing 159,463 square feet, bounded north-easterly by the south-westerly side line of Summer Street, the consideration being $260,728.50. This deed was given in accordance with the provisions of two bonds from the Commonwealth to the said Carter and others, dated Jan. 10, 1899, and June 12, 1900, respectively.

On May 20, the Board executed a lease from the Commonwealth to the Boston Molasses Company of a parcel of land on the Commonwealth flats north-easterly of Summer Street, containing about 249,287 square feet; also a pile

pier in front of the leased premises, to be built by the Commonwealth. The lease is for fifteen years from July 1, 1903, the yearly rental being $9,500.

Heretofore it has not been the policy of the Commonwealth to pay a brokerage commission for the sale of her lands; but during the past year, acting under the advice of the Governor and Council, the Board acceded to the request of the Boston Real Estate Exchange, which had last year petitioned the Governor in favor of the policy of allowing such commissions, and the Commonwealth now pays the usual commissions to real estate brokers.

In May the engineering force ran out the lines of the streets south of Summer Street, and set stone bounds at the corners. The work of filling with material brought to the flats from cellar excavations and similar sources in the city by various contractors has been continued, over 40,000 loads having been delivered during the past year. This material has been used in surfacing the flats on the northerly side of Summer Street, which had been filled with material dredged from the harbor. In portions of this area the harbor filling had settled, and the material brought from the city was used in bringing these low spots up to the general level, and, in addition, the balance of the filling was covered with a coating, raising it generally to a grade of about 14 feet above mean low water. This was accomplished early in the fall, and since then the material has been used in filling in the lands between the streets south of Summer Street and east of C Street.

The building of the sea wall of granite blocks on a foundation of concrete and piles, all properly ballasted, on the northerly side of the Reserved Channel, under contract with William J. Lawler, dated March 7, 1901, was completed in May, 1902, 1,335.3 lineal feet of wall 18 feet high having been built at a cost of $75,431.09, or $56.49 a running foot.

The work of filling the area lying east of the land leased to the Metropolitan Coal Company and enclosed by the sea wall and bulkhead completed last year was begun about Sept. 1, 1902, and has been carried on up to the present time with a view to completing that portion of the area which has

been leased to the Boston Molasses Company. In all 60,578 cubic yards of filling have been put in place up to Dec. 1, 1902.

In order to prepare for occupancy the lot leased as above, a contract was entered into on July 3, 1902, with the J. S. Packard Dredging Company, the lowest bidder, to dredge a berth 18 feet deep on the westerly side and 12 feet deep on the easterly side of the proposed wharf, with an approach 18 feet deep at mean low water from the channel which leads in from the main ship channel of the harbor. This work is finished, 75,522 cubic yards of material having been excavated and deposited at sea at a cost of $10,845.04, the contract price being 14⅞ cents a cubic yard.

On July 10, 1902, a contract was entered into with George Hayes & Co., the lowest bidder, to build a wharf of oak piles and hard pine timber, 300 feet long and 50 feet wide, to be used by the Boston Molasses Company. This work has been done at a cost of $11,500.

On Sept. 4, 1902, a contract was entered into with Jones & Meehan, the lowest bidder, to build drains and catch-basins and pave the street necessary to give proper access to the lot leased as above. The drains and catch-basins have been built, and the paving of the approach is well under way and will shortly be completed. In order to raise the approach to the necessary grade for the pavement, an agreement was made with the New England Dredging Company to furnish and deposit on the premises about 2,000 cubic yards of coarse gravel taken from Shirley Gut.

Commonwealth Pier.

Under chapter 513 of the Acts of 1897, the Legislature authorized the construction of a pier and dock on the Commonwealth flats at South Boston, at an expenditure not exceeding $400,000. This pier, 1,200 feet long and 400 feet wide, creating a surface of wharf area of about 11 acres, has been built, saving a portion of the solid area yet remaining to be gravel surfaced.

The dredging of the dock on the westerly side of the pier, under a contract entered into on Sept. 6, 1901, with the

Eastern Dredging Company, was completed in February, 1902, and there is now in that dock a depth of 30 feet at mean low water for its whole length and width out to the boundary line between the premises of the Commonwealth and of the New England Railroad Company, the width at the outer end being 175 feet and at the inner end 200 feet. The berth at the outer end of the pier is about 30 feet wide, and has a depth of 30 feet at mean low water. Between this berth and the ship channel there is a depth of only 23 feet. On the easterly side of the pier there is a varying depth of from 15 to 4 feet at mean low water.

In October and November the Board permitted vessels loaded with coal and sugar to make use of the dock on the westerly side of the Commonwealth pier and the berth at the end of the pier, for the purpose of discharging their cargoes into lighters alongside, the charge being fixed at 10 cents per ton. From this source there has been collected, up to December 1, and paid into the treasury of the Commonwealth to be credited to the Commonwealth's flats improvement fund, the sum of $3,875.96.

Northern Avenue and Bridge.

After many years of persistent labor and the overcoming of serious obstacles, the Board succeeded in uniting the city of Boston and the New York, New Haven & Hartford Railroad Company in a plan for carrying out their agreement with the Commonwealth, made in 1873, for building Northern Avenue, to connect the Commonwealth's flats at South Boston with the city proper. The city and the railroads had reaped the benefits accruing to them respectively under that agreement, and recognized the justice of giving to the Commonwealth the benefits thereunder accorded to her. It is of moment to the Commonwealth, having invested large amounts of money in improvements designed to facilitate the trade and commerce of the port, to have the agreement of 1873 performed, and to be placed in a position to derive an income from her past expenditures, as well as to be able to continue the projects for extended accommodation.

With a full appreciation of the great public advantages in

view, chapter 507 of the Acts of 1901 was passed, and Northern Avenue was laid out and its construction provided for in accordance with the agreement of 1873, dependent only upon the acceptance of the act by the city council of Boston. In October, 1901, the Board wrote the mayor, inviting action by the city council, but none was taken. Again in 1902 the subject was brought to the attention of the mayor, and he gave a hearing at the city hall on February 18, at which public-spirited representatives of the mercantile and commercial organizations and others prominent in business affairs forcibly presented the necessity for immediate co-operation on the part of the city; but local and private interests antagonized the acceptance of the act.

A good deal is being said and written about the Commonwealth joining in the projects of the federal government for deepening and widening the harbor channels, and sharing the expense; and sometimes it is said the Boston municipality should be added, thus creating a triplicate power, for the purpose of a speedier accomplishment of the objects in view. It is extremely doubtful if the somewhat prodigal proposal to share the expense of the project with the United States would do more than add to the citizens' tax bills; it is highly improbable that any such generous offer could be made to hasten the completion of the projects. The federal government is performing its function in providing adequate channels for the needs of growing commerce. The Commonwealth is doing its duty in improving the anchorage basins for craft of any size which seek the waters of the harbor and the bays.

The Commonwealth has, moreover, begun the construction of a series of large piers and docks upon its extended water front at South Boston, in order to provide accommodations for commerce and facilities for business in advance of its growth, and to be in readiness to offer opportunities, and to prevent loss of trade by reason of unpreparedness. The first of the great piers is built, and awaits the avenue of approach to the heart of the city. While in this condition it was of some use in November, when, as a sequence of the coal strike, a large number of colliers, all from foreign

ports, sought berths for lightering their cargoes of coal. Even then the pier could not be utilized for storage and distribution because of lack of a proper avenue of approach.

Amid this expenditure of millions by the federal government and the Commonwealth for the benefit of the port of Boston, the municipality is asked to do but one thing, and that is, to perform its part of the agreement of 1873 as the other parties have performed theirs.

Had the Board in its earlier efforts in 1898 been able to achieve that unanimity of action which resulted in the passage of chapter 507, Northern Avenue bridge might now have been built, and the widening of the draw of Congress Street bridge, at present demanded by the requirements of commerce, accomplished with but comparatively little inconvenience and without the unnecessary cost to the city of a temporary bridge.

The Board recommends such further legislation as may be necessary to accomplish the desired object.

The Commonwealth Flats at East Boston.

A hearing relative to the claim of the East Boston Company for damages sustained by the taking of its flats by the Commonwealth on Oct. 28, 1898, under the provisions of chapter 486 of the Acts of 1897, began in November, 1902, before an auditor appointed by the Superior Court for the county of Suffolk, and the matter is still pending.

A proper adjustment of trunk line terminals at East Boston is of material interest to the public at the present time, because, whatever conclusions may be reached, they are likely to be final. The growth and development of the shore front and interior of the district will be inevitably along the lines determined by the grade crossing commission, sitting under the provisions of chapter 462 of the Acts of 1900, which ought to be clothed with power not only to eliminate the grade crossings, but to so rearrange the location of all the railroad tracks as to permit of the most available use of the territory for the purposes for which it is best adapted, with a view to economical handling of goods,

wares and merchandise, and dealing with all transportation problems.

When East Boston is encircled with a marginal freight railroad having a spur to every wharf and an elevated passenger service from the end of the tunnel, she will begin the achievement of her destiny; and the plans on broad lines should be matured while the opportunity is open. Let the building up and the details keep pace only with the demand for use and enjoyment.

Fort Point Channel.

On November 6, notice was received from Lieut.-Col. W. S. Stanton of a hearing to be held on Nov. 17, 1902, relative to requiring the draw opening in Congress Street bridge and that in Mt. Washington Avenue bridge across Fort Point Channel to be widened to a least width of 50 feet.

The widening of these draw openings will be a distinct benefit to navigation, and permit vessels of greater beam to dock at points above these bridges.

South Bay.

Early in February, 1902, a petition was received from the owners and tenants of the wharves along the southerly and westerly shores of South Bay, asking that the channel in front of their wharves be made wider and deeper. After due consideration plans were prepared for a channel 110 feet wide and 12 feet deep at mean low water, extending from Dover Street bridge along the westerly and southerly sides of the bay, with an enlarged basin in the angle at the mouth of Roxbury canal. Proposals for this work were received May 22, 1902, but were rejected, as being too high. In July a contract was entered into with John C. Cobb to do the work for 23 cents a cubic yard, measured in scows, that being less than the lowest bid, the excavated material to be deposited within the area which the Roxbury Central Wharf and the South Bay Wharf and Terminal Company were authorized to fill under licenses from the Board. The amount of material dredged up to December 1 is 132,782 cubic yards.

This work is paid for from the "Improvement of South Bay in the city of Boston fund," created by chapter 278 of the Acts of 1898, and composed of all moneys paid into the treasury of the Commonwealth for the displacement of tide water in South Bay.

In the summer of 1902 a long-protracted controversy was settled, whereby the Roxbury Central Wharf and the South Bay Wharf and Terminal Company paid into the South Bay improvement fund the sum of $17,500 net. The Roxbury Central Wharf had petitioned the court to have damages awarded under the decision of Bent *v.* Emery, 173 Mass. 495, for taking its property in South Bay for the purpose of making a channel. It had also, in conjunction with the South Bay Wharf and Terminal Company, filed petitions for licenses to fill in tide water over flats within the harbor line of South Bay. The corporations resisted the claim made by the Board for tide water displaced, contending that the Commonwealth could not rightfully charge for tide water displaced by filling upon flats below mean high water, the surface of which had been artificially lowered, although thereafter for more than twenty years the tides had flowed and ebbed thereover; they also disputed the location of certain channels in the flats claimed to be Commonwealth's land, and denied the existence of the same as natural channels.

These vexed questions have been before the Board for several years, and their elimination at the present time will favor the progress of important and valuable improvements hitherto hampered. The result is not only a substantial addition to the South Bay improvement fund, but an agreement has been made and is on the files of the Board, whereby the Commonwealth, free of claim for damages, may remove by dredging any material from the estates of either or both the Roxbury Central Wharf and the South Bay Wharf and Terminal Company lying outside the harbor line in South Bay at any time hereafter.

As stated in the report of the Board for 1901, a claim of the Commonwealth against the Old Colony Railroad Company for $17,250 for tide water displaced by filling done in

South Bay was in the hands of the Attorney-General. This case has been decided by the Supreme Judicial Court adversely to the Commonwealth, on the ground that the work done under chapter 519 of the Acts of 1897 was in accordance with the expressed command of the Legislature and in the interest of public security and convenience, and that the statute did not contemplate that compensation for tide water displaced should be assessed in this particular instance. (See opinion of the court in Bradford *v.* Old Colony Railroad Co., 181 Mass. Reports.)

Mystic River.

On April 11, 1902, the Board approved plans submitted by the Board of Metropolitan Park Commissioners for a new bridge, authorized by chapter 491 of the Acts of 1901, across Mystic River near the site of the old Middlesex Avenue bridge.

These plans provide for a pile bridge with a retractile draw therein, and a passageway for vessels 50 feet wide. The license for this work requires that the material used for filling the approaches to the bridge in tide water, to the grade of 13 feet above mean low water, shall be dredged from Mystic River to such depths, having due regard to the straightening and widening of the present channel in this river between the Boston & Maine Railroad bridge, western division, and the new bridge, as the Board shall from time to time prescribe.

On April 25, 1902, the Board granted a license to the Boston & Maine Railroad to fill flats at the Dirty Marshes, so called, and to build a pile platform, on Mystic River in Somerville. This license authorized the work to be done between the Boston & Maine Railroad bridge, Western Division, and the easterly side line of location of the Middlesex Fells Parkway, the outer line of the pile platform being in continuation of the outer line of filling constituting the approach to the Middlesex Avenue bridge on the Somerville side of the river.

The licensee therein agrees to dredge an area in Mystic River between said railroad bridge and the easterly side line of the parkway, excepting that portion adjoining and 50 feet

outside of the line of the railroad bridge, to a depth not less than 4 feet below mean low water, all the dredging to be done within two years from the completion of the Middlesex Avenue bridge by the Metropolitan Park Commissioners; also to dredge in such localities and to such depths, having due regard to the straightening and widening of the present channel in said river between the railroad bridge and the Middlesex Avenue bridge, as the Board shall from time to time prescribe, so that the channel shall be not less than 100 feet wide and 9 feet deep at mean low water.

As the work covered by these two licenses was, in part, beyond the harbor line approved by the Secretary of War, June 20, 1890, the licensees were required to obtain his consent. On May 29, 1902, the United States harbor line covering this frontage was modified, thus enabling the licensees to do the desired work.

The river in this locality makes a wide bend with the main channel, curving well to the north of the middle, and at low tide a large area of unsightly flats is exposed. The gain by lowering these flats to a plane of 4 feet below mean low water is sanitary and utilitarian, as well as æsthetic.

Merrimac River.

May 26, 1902, the Legislature adopted, in concurrence, the following order: —

Ordered, that the Board of Harbor and Land Commissioners investigate and report on the feasibility and advisability of opening the Merrimac River to navigation from Lowell to the sea. Said Board shall report, with such suggestions and recommendations as it may deem proper, to the next General Court, on or before the first Monday of February.

No appropriation was made for the investigation indicated in said order, therefore, the Board inferred that the General Court sought an examination and statement of the surveys already made by the United States Engineers, together with a report and opinion thereon without any original surveys and investigation by the chief engineer of the Board and his assistants.

Acting on that view, the Board has examined the reports of the United States Engineers who have surveyed the river from Haverhill to Lowell, and made reports thereon; and the chief engineer of the Board has made studies and examinations of the plans referred to by the United States Engineers; also, the Board has made a personal inspection of that part of the river, for the purpose of gathering general information on the subject.

Much work has been done by the United States at the mouth of the river and from Newburyport to Mitchell's Falls, 21½ miles above Newburyport and about 3 miles above Haverhill.

The depth of water over the bar at the mouth of the river has been increased by the construction of jetties which confine the current and force it to scour a channel through the bar.

Work is now in progress for widening and deepening the channel from Newburyport to Haverhill. About $600,000 has been expended to the present time on those two improvements.

According to the last United States survey, in 1901, there was 12.6 feet in the channel over the bar, and at ordinary high tide there is 12 feet of water to Haverhill bridge and 10 feet to Mitchell's Falls, about 3 miles above Haverhill bridge, and a depth of 4.5 feet through Mitchell's Falls to the head of the upper falls. This depth over Mitchell's Falls is only maintained when the mill water at Lawrence is running.

An examination of the river at Mitchell's Falls was made by Prof. Henry Mitchell, of the United States Coast Survey, at the expense of the Pentucket Navigation Company, and his report and plan are in the report of the United States Coast Survey for 1867, and a copy of the report is contained in the annual report of the Chief of Engineers, U. S. A., for 1870, page 474. He reported that the river could be made navigable for barges drawing 4 feet of water, without the construction of locks, by excavating channels through the falls, and drawing barges through the channels by means of tow boats fitted with windlasses.

Maj. Gen. J. G. Foster, of the United States Engineers, made a similar report in 1870 on the same subject. (See annual report of the Chief of Engineers, U. S. A., for 1870, pages 471–473.)

In 1872 surveys and estimates were made for the improvement of navigation of the river between Haverhill and Lawrence, and a report made thereon by Brigadier-General Thom and his civil assistant, Mr. Gorham P. Low, Jr. This report can be found in the annual report of the Chief of Engineers, U. S. A., for 1872, pages 961, 963.

Later surveys, covering the river as far north as Manchester, N. H., were made under direction of General Thom by Mr. Sophus Haagensen, and are found in the annual report of the Chief of Engineers, U. S. A., for 1882, Vol. 1, pages 532, 534.

Blue prints of the plans accompanying the reports of the United States Engineers are now on file in the office of this Board.

There are other published reports of the United States Engineers on the surveys of the river between Haverhill and Lowell, but the reports above referred to contain the most careful surveys and best opinion obtainable on the subject.

Plans at the office of the Essex Company at Lawrence show surveys of the river from Mitchell's Falls to the dam in Lawrence, and plans on file in the office of the Locks and Canals Company at Lowell show the river from the Lawrence dam to the dam at Lowell, including respectively sets of plans of the locks and canals over the falls at Lawrence and Lowell.

In 1870 was begun the excavation of a channel through the lower portion of Mitchell's Falls; and at the end of 1874 channels 60 feet wide and 4 feet deep at ordinary water, with mill water running at Lawrence, had been excavated through both the upper and lower falls.

These channels were used principally for navigation by the Pentucket Navigation Company, which for a time maintained at the head of the channel a scow with winding engines operated by a flutter wheel driven by the current. This has not been in use for many years.

This work was the carrying out in part of the improvements planned by General Foster and General Thom, excepting that the bars of the river between Mitchell's Falls and Lawrence were not excavated.

At the lower falls the mean tide rises between 3 and 4 feet.

In the opinion of the Board, the best way to improve navigation between Haverhill and Lawrence would be the construction of a dam and lock at Mitchell's Lower Falls, the removal of boulders and the dredging in shoal spots of the river between the upper falls and the lower lock in the canal at Lawrence, and the raising of bridges or the substituting of draw bridges over the canal from the lower locks to the dam of the Essex Company at Lawrence.

No accurate surveys and measurements have been made by the chief engineer of the Board to ascertain the cost. It is assumed that a dam at Mitchell's Lower Falls, 4 feet high, with a lock of about the same size as the lower lock of the canal at Lawrence, would be sufficient. That would allow navigation of the river from Haverhill to the lower locks at Lawrence for barges drawing about 4 feet of water.

There are three locks in the lower canal at Lawrence, 100 feet long and 20 feet wide, but over the sill of the lower lock there is only about 2.5 feet of water at ordinary low water in the river. After passing the lower locks into the canal there are fourteen bridges over the canal, connecting the city proper with the mill yards. Five of the bridges are railroad, two are highway and seven owned by the Essex Company and several mills, for the mill operatives, teaming and general use. The distance from the lower locks to the dam is about 1 mile. Under these bridges there is very little head room, — in some instances not over 2 feet. It would be impracticable for barges or lighters to use the canal without raising the bridges or constructing draws therein.

The fall of the river at Lawrence from the dam to the lower locks is about 28 feet.

From the dam at Lawrence to Hunt's Falls below Lowell, at the junction of the Merrimac and Concord rivers, about 9 miles, navigation is practicable after dredging away the shoals and boulders near its upper end.

At Hunt's Falls there are two sections, the upper and lower falls. From the basin above the falls, near the first lock on the Lowell canal to the basin below, is about 5,700 feet, and in that length of river there was a fall of about 11 feet in 1881. This has been reduced by the Locks and Canal Company, so that now the upper basin above the falls is only 7 or 8 feet higher than the basin below the falls.

The fall in the river in the 9 miles from Lawrence dam to Hunt's Falls is only about 1 foot, and the channel is from 5 to 30 feet in depth, excepting one rocky shoal and some boulders which could easily be removed. At Hunt's Falls the current is very rapid, and the river bed is rocky and irregular and only 2 or 3 feet in depth for some distance.

At Hunt's Falls, in the opinion of the Board, it would be necessary to construct a dam and lock to aid navigation. It would not be practicable to cut away the falls sufficiently to allow barges to be drawn through a channel, because this would decrease the depth of water in the river above to less than the required navigable depth.

There are three locks in the canal between the Concord River and the pond above the Lowell dam. The length of the locks respectively is about 100 feet; the width of the lock gates is only 12 feet, and the locks would be available for craft drawing only 3 feet of water.

This canal from the lower locks at the Concord River junction to the dam above passes directly through the city. The fall from the dam to the lower lock is about 32 feet. Across this canal also are five highway bridges, three railroad bridges, and two mill bridges. Just above the lower locks is an old highway bridge, and the head room between the average surface of the water in the canal and the truss of the bridge is only 18 inches. This is a much-travelled street in the city, fully occupied on both sides with mills, warehouses or stores. It would be very expensive to raise the bridge, on which buildings have been erected on either side of the travelled way, or to make a draw therein.

General Thom in his report above cited (page 534) makes this estimate of the cost of a comparatively small part of the work necessary to open navigation from Lowell to the sea:

"The estimated cost of the several works projected as above for making the channel navigable from the head of Mitchell's Falls (6 miles below Lawrence dam) up to the basin above Pawtucket dam in Lowell (*exclusive of new locks at Lawrence and Pawtucket dams*) is $236,000."

In the opinion of the Board, this report excludes the two largest items of cost.

The basin above Hunt's Falls near the lower lock in the canal at Concord River junction might be developed with wharves and docks, but would be a poor location for delivery of freight. The canals at Lawrence and Lowell are now very little used for the passage of boats. Many years ago rafts of logs and spars or masts were carried through the locks. There was also some other freight carried through the canals. Careful records of both canals have been kept of the passage of barges, row boats, launches and canoes. The locks have been used for that purpose only a few times each for the last twenty-five years. No freight has passed through the canals for many years.

The locks of the Lawrence canal have been little used for the last twenty-five years. The record shows that only the following craft have passed the canal in the last three years: 1 steamer, 5 row boats, 14 canoes, 6 sloops, 4 boats, 2 scows, 8 dories and 1 gunning float, — 41 in all. Of these, 12 were carried around the locks by employees of the Essex Company to save the trouble of opening the locks and floating them through.

The street follows the left bank of the Lawrence canal most of the way from the lower locks to the dam. The right bank of the canal is covered with warehouses, mills and mill yards. There seems to be no suitable place on either side for wharves or docks.

The Board cannot give the approximate cost of the improvements indicated, for the reason suggested at the beginning of this report. In its opinion, however, the cost of the dam and lock at Mitchell's Falls and at Hunt's Falls, respectively, and the dredging of shoals and boulders at several places in the river between Haverhill and Lowell, would be the smallest of the items of cost. A very large

expense would be the raising of the bridges to make more head room, or providing the same with suitable draws; but larger than all would be the damages caused by the loss of power to the many mills on the banks of the two canals, and no approximate estimate of the cost can be given.

The dam at Mitchell's Falls would decrease the flow and fall of water at the lower locks and mill raceways in the canal at Lawrence. This would probably not cause so large damage and loss of power as the dam and lock at Hunt's Falls in Lowell. The building of a dam there would reduce the water power available for all the mills on the several canals in Lowell about 4 feet.

The cost of the work, including the building of two dams and locks, dredging shoals, removing boulders, damages to water power and cost of street and bridge changes in Lawrence and Lowell, could only be accurately determined after a long and expensive investigation by engineers and experts.

When completed, as above suggested, without substantially enlarging the locks (except at the lower lock in Lawrence), the river would be navigable to and through Lawrence by barges 20 feet wide, 100 feet long and drawing 4 feet of water; and to and through Lowell by barges 12 feet wide, 100 feet long and drawing 3 feet of water. Barges or craft of that size would not be safe for transporting freight even from Boston harbor. All freight for Lawrence or Lowell would require rehandling at Newburyport or Haverhill.

The amount of freight tonnage for the cities of Lawrence and Lowell should be considered in this connection. For the year ending June 30, 1902, all the freight carried into the two cities by the Boston & Maine Railroad was as follows: —

Carried into Lawrence: —	
Tons of coal,	246,031
Tons of all other freight,	450,917
Carried into Lowell: —	
Tons of coal,	295,697
Tons of all other freight,	520,145

Coal would be more likely to seek water transportation than other freight. The mills for the most part have spur tracks to their boiler rooms. The necessary rehandling of coal in the lower river and the carting from canal to boiler room would have to be added to the water-borne freights in offsetting the greater all-rail coal rates; and the difference in cost of transportation would probably be small. The outgoing freight from the two cities would largely be by rail.

The work of opening the Merrimac River from Lowell to the sea would be feasible and practicable from the engineering point of view; but, considering the large cost and the damages involved, and the relatively small savings on freight which must be rehandled on the lower river and transported in such small barges, the Board reports that, in its opinion, it is not advisable for the State to undertake the large expense of opening the river to navigation from Lowell to the sea.

The United States Engineers have for years made surveys and reports on this work, and the United States has expended large sums to improve the navigation of the Merrimac River. Apart from the large expense, it may be better to leave the work in sole charge of the United States.

Connecticut River.

In the spring of 1902 willow cuttings were placed on the bank of the river at Hadley which was protected by the riprapping done during 1901, extending along the bank a distance of 1,455 feet. Slight repairs were also made where the riprapping had been undermined by surface water, due to changes which had been made in the grade of the street, and alterations made in the drain to obviate any recurrence. A portion of the balance of the appropriation made by chapter 94 of the Resolves of 1901 was expended in the construction of a dike at a point just below the bridges crossing the river between Northampton and Holyoke, where the river had broken through the bank into a borrow pit which was dug when the grade of the adjacent street was raised, and was likely to do serious injury unless preventive measures were adopted, and in riprapping the river bank

in front of the dike to prevent its being undermined. The dike was constructed under a contract entered into with Seymour & Newell, the lowest bidder, on May 9, 1902. The riprapping of the bank was done by day labor, the stone being furnished under a contract entered into with Thomas H. Kiely, the lowest bidder, on Sept. 4, 1902. The cost of all this work is $4,772.96, as appears in detail in the report of the engineer in charge.* It is not anticipated that it will be necessary for the State to do any further work for the protection of the river banks in the town of Hadley other than such small repairs as may be called for from time to time caused by damages from surface water.

The total amount expended at Hadley, up to Dec. 1, 1902, is $56,704.58.

New Bedford and Fairhaven Bridge.

The Legislature, by chapter 439 of the Acts of 1900, constituted the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners a Joint Board, to prescribe the manner in which so much of the highway, bridge and approaches as remained to be completed should be constructed, and to approve all plans, specifications and requirements necessary to finish the undertaking. Under this authority votes approving the construction contracts as reported last year to the Legislature were passed, and the work has proceeded to completion, the Joint Board keeping informed of its progress, and holding such conferences as were necessary.

At a meeting of the Joint Board, held Sept. 8, 1902, a communication dated Sept. 4, 1902, was received from William F. Williams, chief engineer, stating that the New Bedford and Fairhaven bridge "is now open for public travel, and all travel has ceased over the temporary bridge." The Joint Board thereupon, in pursuance of the terms of a contract between Cole Brothers and the city of New Bedford, dated Sept. 11, 1900, requested the contractor to remove the temporary bridge, and it has been done.

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* See Appendix B.

A hearing was given Nov. 24, 1902, by the Joint Board to contractors engaged in the work of completing the bridge, relative to several items of extra work, amounting in all to $684.23; and the claims, being considered equitable, were approved.

The construction of that portion of the bridge under the supervision of the Joint Board is now complete, and the duties with which they were charged appear to be concluded.

Approximately, the cost of building that part of the bridge under the act amounts to $290,000. This sum does not include land damages, of which $23,000 has already been paid.

Apponagansett Harbor.

By chapter 509 of the Acts of 1902 the Board was authorized and directed to improve the harbor at Apponagansett in the town of Dartmouth by building a stone breakwater at its entrance, substantially in the location recommended in the annual report of the Board for 1901, and to expend not exceeding $30,000 therefor. After an examination of the locality and conference with parties specially qualified to form a judgment and those interested in the improvement, it was decided to build a stone breakwater of granite quarry-grout, 5 feet wide on top at an elevation 6 feet above mean low water, and with the sides sloping at angles of 1 on 1½.

The breakwater was planned to begin at a point about 250 feet from the high-water line, where there is a depth of about 4 feet at mean low water, in order to allow small boats to pass near the shore.

With the appropriation available it was estimated that a breakwater 700 feet long could be built of the dimensions above described, and on July 31 a contract was entered into with E. S. Belden & Sons, the lowest bidder, to build the same for the sum of $1.07 per ton of stone placed in the work. Up to Dec. 1, 1902, 14,191 tons have been built into the breakwater, the contract providing that the whole shall be completed on or before July 1, 1903.

Cataumet Harbor.

By chapter 71 of the Resolves of 1902 the Board was directed to cause a survey and estimate to be made as to the cost, best method and advisability of improving Cataumet harbor, and authorized to expend not exceeding $500 therefor. This harbor is an indentation in the easterly shore of Buzzards Bay, on the boundary line between the towns of Bourne and Falmouth, and lies conveniently between the railroad stations of Cataumet and North Falmouth. The harbor is open to the south-west, and the anchorage is well protected from northerly and easterly winds. The prevailing winds through the summer months and yachting season are from the south-west, to which the anchorage is exposed. There is a small area forming a channel leading to the wharf on the Megansett side of the harbor, which is partially protected by the shoal making out from the point on which the wharf is located. The deeper-draught yachts anchor on the easterly side of this channel, thereby obstructing and rendering it difficult for the steamer which plies along this shore of the bay through the summer to make a landing. Leading from this anchorage is a narrow channel having a depth of from 2 to 4 feet at mean low water for a distance of about half a mile, and continuing for another half mile with a depth of not less than 1 foot at mean low water. This channel leads into Squeteague Pond, where there is an anchorage of about 17½ acres, with a depth of not less than 5 feet at mean low water. Many of the smaller boats are kept along this channel and in the pond, passing in and out at or about high tide.

Upon inquiry among parties interested in the harbor and having summer residences in this vicinity, it was learned that the owners of the larger yachts desire to have an anchorage dredged out near the steamboat landing, while the owners of some of the smaller boats and those residing on the shores of Squeteague Pond desire to have a channel excavated into the pond, so that it can be used for the anchorage of their boats, which may then get in and out at all stages of the tide.

In order to determine the practicability of any of these projects, a survey was made of the harbor from the outer entrance of the channel leading to the steamboat wharf up to and including Squeteague Pond. This was done during August and September, and the results plotted on a scale of 1/2000. Nearly 4¾ miles of shore line were surveyed, and 5,800 soundings and levels taken over an area of about 169 acres. On the plan were laid out the various projects for improvement.

Three such projects have been prepared, shown on the plan appended, one for dredging an area of about 14 acres easterly of and adjoining the channel leading to the steamboat landing, where an anchorage basin would be partially protected by the point on which the steamboat landing is located and the shoal extending from it. It would be desirable to dredge the westerly portion of this area to the depth of 9 feet at mean low water, to accommodate the larger boats, and the inner portion to 6 feet at mean low water. The following is an estimate of the cost of the work: —

9 foot area, 39,800 cubic yards, at 30 cents, . .	$11,940
6 foot area, 64,000 cubic yards, at 30 cents, . .	19,200
Incidental and contingent expenses, 10 per cent., .	3,114
Total, ...	$34,254

This estimate is based on the use of the ordinary style of dipper or clam-shell dredge; but if a hydraulic dredge could be obtained for use on the work it could probably be done for a smaller price per cubic yard. In that case, however, the depth on the 6 foot area would have to be increased to enable the dredge to work properly, and this would add largely to the amount of material to be excavated, so that the final cost of excavating an anchorage basin of the same area would probably not be materially less than as stated above.

The other two projects are designed to give access to Squeteague Pond, in order that the deep-water area there may be used for an anchorage. One project is for a channel 6 feet deep at mean low water and 200 feet wide, cutting through the beach at the westerly corner of the pond. The

opening being into the outer portion of the main harbor, the entrance of the channel would have to be protected by two stone jetties similar to those built by the Commonwealth at Cottage City. The cost of this project is estimated to be as follows: —

Dredging the channel, 78,000 cubic yards, at 35 cents,	$27,300
Building stone jetties and riprapping slopes of channel through beach, 6,000 tons stone, at $2.50,	15,000
Incidental and contingent expenses, 10 per cent.,	4,230
Total,	$46,530

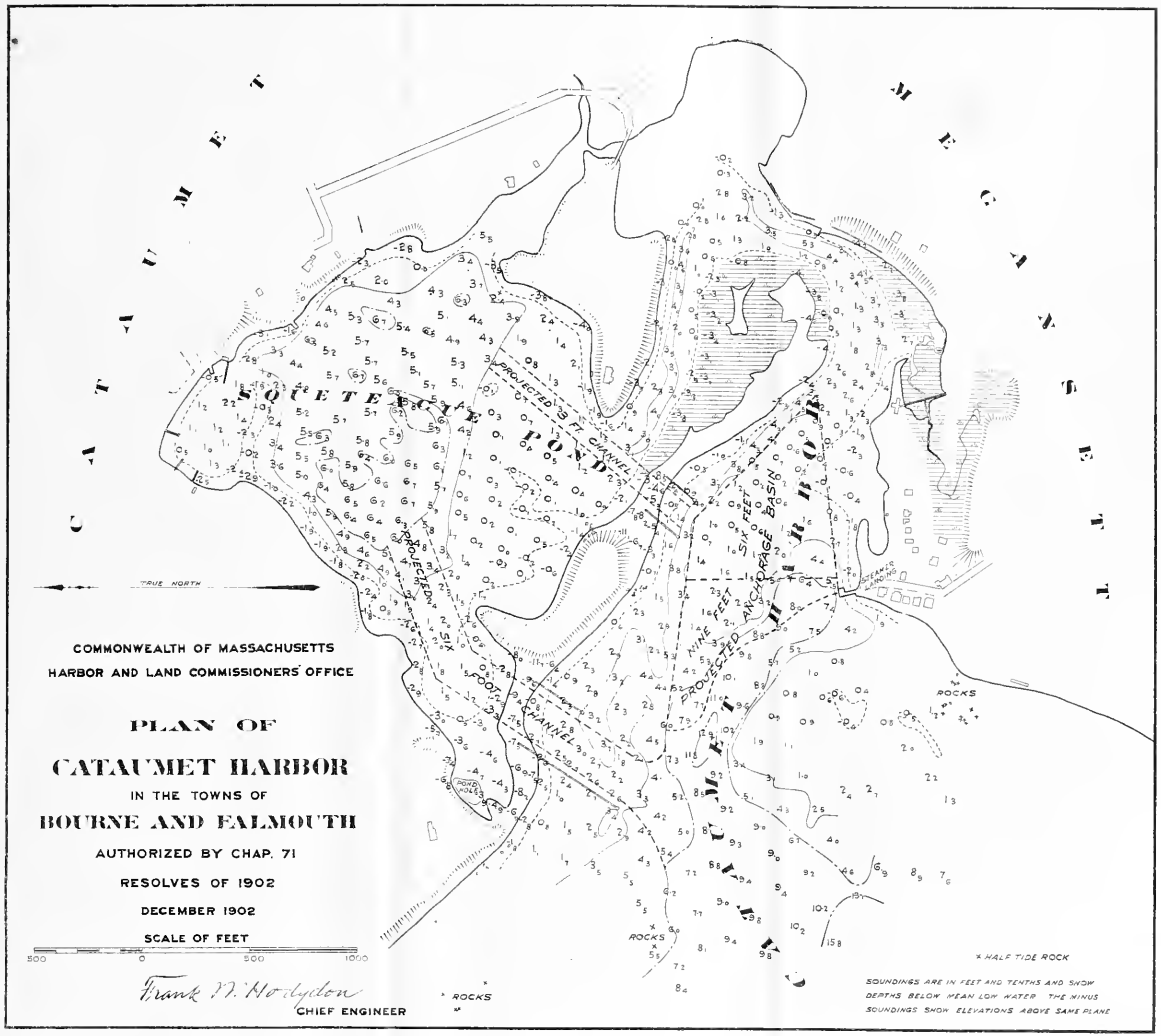
The third project provides a channel 3 feet deep at mean low water and 100 feet wide, leading from the inner portion of the harbor through the beach into Squeteague Pond. This would accommodate only the smaller class of boats and makes no provision for the larger ones. The cost of the dredging contemplated by this project would be comparatively large, as, owing to the depth of water, only small dredges and scows could be used. The cost of this project is estimated to be as follows: —

20,000 cubic yards, at 50 cents,	$10,000
Building stone jetties and riprapping slopes of the channel through beach, 2,200 tons, at $2.50,	5,500
Incidental and contingent expenses, 10 per cent.,	1,550
Total,	$17,050

In making the above estimates no account has been taken of any land damages. If either of the projects for using Squeteague Pond should be adopted a considerable section of the neck of land lying between the pond and the harbor would be cut off from connection with the main land; and, although this is apparently not used for any purpose at the present time, it cannot be assumed that the owners would not want damages. If either of these plans should be adopted, a portion of the material excavated from the channel could be used in building a causeway to connect this portion of the neck with the main land.

The Board does not deem the advantages to the public to be commensurate with the cost of the improvement.

The amount expended by the Board from the appropriation is $356.33.



HELIOTYPE PRINTING CO., BOSTON

Nantucket Harbor.

In January, 1902, a petition was received from the selectmen of Nantucket and others, asking for the removal of certain rocks in Nantucket harbor claimed to be dangerous to navigation.

In June an inspection was made by the Board and the chief engineer, and it was decided to take out the boulders. In consideration that Congress had made an appropriation for the improvement of this harbor, and in expectation that the contractors for the government would be at work there during the year, with whom a contract might be made for removing these rocks for a far less sum than would be required in employing a contractor with proper equipment to go to Nantucket for that purpose alone, the matter has awaited opportunity of accomplishment without disproportionate expense to the Commonwealth.

Scorton Harbor.

In 1898, under the authority of chapter 442 of the Acts of that year, a new outlet for Scorton River was excavated through the beach at an expense of $2,940. Shortly after the completion of the work the great storm in November of that year greatly enlarged the cut which had been made, and since that time the marshes and cranberry bogs lying along the river have been thoroughly drained and the harbor used to some extent by fishermen.

Physical changes soon took place, as was anticipated, and a shoal at once began to form on the westerly side, developing into a tongue or spit parallel with the shore, thus forcing the channel inside, which in turn cut out the bank on the easterly side at about the same rate of progress. The river mouth is constantly moving south-easterly, as the outside spit builds up by current and wave action, and the shoaling of the entrance causes the sea to run in combers, rendering entry unsafe and often impossible.

Pursuant to chapter 130 of the Resolves of 1902, requiring the Board to make an investigation as to the advisability and cost of completing improvements at this place, a survey was made in September at a cost of $68.70. The low-water

entrance to the harbor has moved between 800 and 900 feet eastward, so that boats now entering the harbor have to sail nearly that distance in the trough of the sea. The people interested in this harbor and the fishermen who use it desire the erection of structures designed to so control and direct the currents and the drift of the sand that the entrance will remain permanently opposite the point where the cut was made through the beach.

The locality is exposed to the full force of the Atlantic, and any structures built there must be strong and solid to be able to resist the continuous pounding of the sea in heavy easterly gales.

A number of years ago, it is said, at the harbor of Sandwich, similarly situated and about 2 miles to the westward of this entrance, the beach was cut through and a single jetty of timber supported by stone built out at right angles to the shore in line with the easterly side of the cut. The current maintained a channel for several years alongside this jetty, until it was broken through by a vessel driving against it; the channel then shifted over to the easterly side of the jetty and maintained itself there for a time. Finally, the structure became so injured that the sand drifted over and around it, and, as a result, the entrance is now being forced to the eastward, as at Scorton harbor.

If any plan is to be adopted for further improving this harbor, it should provide for the construction of a stone jetty starting from the sand ridge on the easterly side of the present entrance and extending north-easterly at right angles to the general trend of the beach, to where there is a depth of about 3 feet at mean low water,—about 600 feet away from the high-water line on the beach to the eastward of the entrance. This should be 15 feet wide on top, with side slopes of 1 on 1½, and built with heavy riprap stone, the centre composed of small chip stone supported and held in place by the large stone in the outer surface.

In addition, the banks of the channel through the ridge of the beach should be protected by stone riprap. At the present time the harbor runs practically dry shortly after half tide, and boats of limited draught can enter and leave it

only at or about high water. There is no basin in the harbor where boats can lie afloat at all stages of the tide. It is not anticipated that the construction of the jetty as described would increase the depth of water in the harbor, but only enable boats to enter at that stage of the tide when there is sufficient depth of water for them, without being obliged to sail for a considerable distance in the trough of the sea. The estimated cost of this jetty is as follows: —

20,500 tons of stone, at $2,	$41,000
4,500 tons riprap, at $2.25,	10,125
Incidental and contingent expenses, 10 per cent.,	5,112
Total,	$56,237

The total amount expended for the improvement of this harbor, up to Dec. 1, 1902, is $3,017.17.

The benefits to this locality would not be commensurate with the cost of the improvement, and, in the opinion of the Board, the expenditure would be inadvisable.

Witchmere Harbor.

No work has been done at Witchmere harbor during the present year. From an examination of the entrance early in the summer it appeared that the channel had deepened slightly, but there is not sufficient depth to enable large boats to enter the harbor. Some difficulty has been caused by the current scouring out the sand from the inner portion of the channel and depositing it in the deep water of the harbor proper, forming shoals.

The Board has received no complaints in regard to sea weed being lodged on the beach this season.

The total amount expended for the improvement of this harbor, up to Dec. 1, 1902, is $4,912.21.

Scituate.

By chapter 434 of the Acts of 1900 the Board was authorized to expend a sum not exceeding $15,000 for protecting the shores and harbor of the town of Scituate. A sea wall 998 feet long was built in 1900 along the crest of the narrow beach at the Sand Hills, between Scituate harbor and the

ocean. Considerable attention was also given to determining at what other point it was necessary to build structures to carry out the objects of the act. After conferring with the selectmen, it was decided that a wall should be built along the crest of the beach lying between Damon's Island and the Glades at North Scituate. As the estimates for the work exceeded the balance available in the appropriation, the town voted to make up any deficiency, and appropriated $3,000 therefor at the March meeting in 1902. Proposals were then invited, and it was found that, owing to the favorable prices obtained, the work could be done within the appropriation made by the Commonwealth, and a contract was entered into on April 17, 1902, with Ward & Cummings, the lowest bidder, to build 1,450 feet of concrete sea wall along the crest of the beach, on the easterly line of the location of the highway over the beach. The work was completed July 30, 1902, at a cost, including superintendence and incidentals, of $6,345.35, or at the rate of $4.37+ a running foot.

Since the completion of the wall the town has reconstructed the highway in a substantial manner.

The total amount expended at Scituate since the passage of chapter 434 of the Acts of 1900, up to Dec. 1, 1902, is $12,189.03.

West Bay, Osterville.

By chapter 491 of the Acts of 1902 the Board was authorized to expend a sum not exceeding $7,500 for further improving, by dredging, the channel from Vineyard Sound to Osterville Bay in the town of Barnstable. After an examination, a contract was entered into with John H. Gerrish on Aug. 8, 1902, to do the work for 32 cents a cubic yard, the same to be completed by May 31, 1903. Prior to signing the contract, releases were obtained from owners of land on the shores of the bay, permitting the dumping thereon of the material dredged, thereby diminishing the expense by avoiding the necessity of carrying that material into the sound.

Lake Anthony.

By chapter 399 of the Acts of 1901 the Board was authorized to expend a sum not exceeding $5,000 for dredging and other work to improve the harbor at Lake Anthony, in Cottage City. In that year the area on both sides of Joy's wharf on the southerly side of the harbor was dredged to the depth of 5 feet at mean low water, in order to enable the boats using the harbor to have free access to the wharf. At the same time ten permanent moorings, consisting of large stones, chains and casks, were placed around the harbor, in order to afford safety to yachts during heavy winds, the bottom being so soft that anchors will not hold. The cost of these moorings and the dredging was $2,863.51. During the present year the balance of the appropriation has been expended in enlarging the anchorage area about 1.3 acres by dredging along the southerly and westerly sides of the harbor for a distance of about 1,100 feet. The material excavated has been placed along the shore opposite the dredged area, making a sharp bank, and enabling vessels to tell definitely the limits of the anchorage area. The sanitary condition of the harbor is also benefited by filling in objectionable flats. The cost of this work was $2,123.10.

An examination of the channel at the entrance of the harbor disclosed that the sea in heavy weather had driven considerable quantities of sand through the spaces between the large stones of the jetties and shoaled slightly the entrance. In order to prevent this, the spaces have been filled with concrete at an expense of $221.23, and the entrance dredged. No further trouble is anticipated from this cause. The total amount expended for the harbor and entrance to Lake Anthony, up to Dec. 1, 1902, is $26,634.97.

Menamsha Inlet.

The conditions at Menamsha Inlet remain substantially the same as reported last year. It was decided to close up the holes between the large stones in the western jetty, to prevent the sea from driving the sand through them into the channel. This was undertaken in the latter part of the

summer, the spaces filled with concrete, and a short wing wall built of the same material, to keep the waves from washing around the inner end of the jetty and cutting out the sand from back of it. As soon as the holes between the large stones of the jetty were filled the current at once cut away the sand in front of the jetty, increasing the depth of the water materially at this place. By cutting off the supply of sand, which was being driven in from the beach to the westward, the sea and current can more easily cut away and deepen the channel through the bar at the entrance.

No material change has taken place where the timber wing jetty was broken down, as reported last year, and the beach at this place has built up nearly as high as at the portions where it is still protected by the timber work; at the same time the average depth of the channel in the rear is as well maintained as it was before the timber work was injured. The total cost of the work done here was $478.49.

As stated in the last report of the Board, in order to secure the best results from the construction of the jetties, it will be necessary to carry out the balance of the work, and excavate a channel from a point between the jetties in a direct line across the flats to the entrance to the pond, and also build two short jetties or training walls to direct the current into the excavated channel. This work from the jetties to the channel opposite the boat landing of Mr. Mosher could probably be done at an expense not exceeding $5,000, provided a dredge suitable for doing the work could be secured somewhere in the vicinity. The total amount expended for the improvement of Menamsha Inlet, up to Dec. 1, 1902, is $10,412.75.

Bass River.

By chapter 113 of the Resolves of 1901 the Board was directed to improve the entrance to Bass River in the towns of Dennis and Yarmouth, in accordance with its report (House, No. 1430), made June 4, 1901, and an appropriation of $22,000 was made for the purpose.

On Nov. 14, 1901, a contract was entered into with Augustus Bellevue & Co., the lowest bidder, and it was expected that work would commence early in the spring, but

subsequently they assigned to Bigelow F. Nay, the assignment was approved by the Board Jan. 16, 1902, and the work was carried out by Mr. Nay. It was commenced early in April and completed Oct. 16, 1902. Two timber jetties were built to confine and direct the current of the river, and prevent the sea from driving the sand off the beaches on either side of the river mouth into the channel. The artificial channel was dug 1,400 feet long and 50 feet wide, straight from a point in the natural channel where it turned sharply to the eastward, about opposite the beach on the westerly side of the entrance.

This was done in order to direct the current in such a way as to scour a channel by the shortest path to deep water, instead of following the devious course it previously pursued. The westerly jetty is 950 and the easterly 2,423 feet long. They are built of oak piles and spruce timber, but nevertheless will require to be strengthened with stone riprap before many years. In building the easterly jetty across the old channel difficulties were encountered, but were overcome by putting in additional piles and using a number of sand bags during construction. The total cost of the work, including superintendence and engineering, amounts to $22,800.50.

The work was planned with a view to a gradual enlargement of the dredged channel in the mouth of the river by aid of the scouring ebb of the tides, — a process which will take time in its accomplishment, and will require watching meanwhile of the structures, in order to meet and avoid unforeseen difficulties.

Had the appropriation permitted, it would have been desirable to continue the dredging farther into the Sound, and thus enable the scour of the river to make a deep and permanent channel at an early day, with less liability to variation after leaving the mouth of the jetties. As it was, however, the cost of the work slightly exceeded the estimate, and the balance of $800.50 was paid from the appropriation for the survey and improvement of harbors, made by chapter 107 of the Acts of 1902.

The total amount expended in improving the entrance to Bass River, up to Dec. 1, 1902, is $23,106.86.

Great Ponds.

It having been brought to the attention of the Board that parties were occupying islands in some of the great ponds of the Commonwealth without satisfactory title thereto, the Board took the opinion of the Attorney-General, which was printed in the report of last year.

Subsequently thereto the Attorney-General was requested to make claim to an island in Chebacco Lake, believed to be occupied under claim of squatter right only, and the matter is now pending in his office.

Hangman's Island.

In December the Board extended the lease to the present lessees of Hangman's Island, in Boston harbor, for three years from Jan. 1, 1902. It is well to have fishermen continue to occupy this island, as they have been helpful from time to time as life savers.

Province Lands.

By chapter 511 of the Acts of 1902 the sum of $10,000 was appropriated for continuing the planting of the sand binders, in order to arrest the blowing sand. Of this appropriation one-third was to be expended in each of the three years succeeding the date of the act, June 26. Owing to lack of funds, nothing was done prior to July, when the road across the lands was repaired. During September, October and November about 20 acres were planted, as usual, with the marram or beach grass (*Ammophila arenaria*), interspersed with bayberry (*Myrica cerifera*) and other shrubs transplanted from the surrounding country. The trees and shrubs are healthy and fairly vigorous, — as much so as could be expected, in consideration of their very exposed location and the lack of fertile soil.

Few situations are more exposed to harsh weather than the Province Lands at the end of Cape Cod. It is therefore interesting to discover what plants will live and flourish under such conditions as there exist. In an effort to ascertain this information, about 20 varieties have been tried,

the varying degrees of success fully appearing in the report* of the superintendent. Of those best adapted to the conditions there prevailing, he enumerates the native pitch pine, Scotch pine, Austrian pine, common alder, black locust, bayberry and Scotch broom. Comparisons made from time to time among the sand barrens which have been redeemed in various parts of the world will be interesting and instructive.

At the head of the harbor of Provincetown, and close to the southerly end of the Province Lands, the dunes are low, and form a narrow ridge between House Point Island flats and the sea. The beach is weak for a distance of some 2,800 feet south of Abel Hill dike, and last winter several inroads were made in the north-westerly storms. During the summer the federal government has been strengthening this beach by building plank and timber bulkheads, filled with sand, also groins of light lattice work and low sand-catching fences. Under this treatment the beach is building up, and danger from breaches of the sea through the dunes is diminished. Since 1826 the government has spent $176,918 in this work.

The total amount expended by the Commonwealth on the Province Lands, up to Dec. 1, 1902, is $28,818.28.

Mt. Tom and Mt. Nonotuck State Reservation.

Pursuant to chapter 124 of the Resolves of 1902, authorizing the Board to make surveys, examinations and estimates, to determine the probable cost of acquiring an area of about 3,000 acres of land situated on or about Mt. Tom and Mt. Nonotuck in the county of Hampshire, suitable for a State reservation, and making an appropriation of $2,000 therefor, the Board, in July, 1902, visited the locality and examined the general outlines of the area referred to in the resolve. Subsequently surveying parties were organized and sent into the region, to obtain the contours, elevations, character and description of the land, and generally such other information as might assist in determining the questions involved.

On July 25 the work of making the necessary surveys was commenced. All available information which could be found

* See Appendix C.

in the offices of the city engineer of Holyoke, the Holyoke Street Railway Company, the Holyoke Water Power Company and the registry of deeds at Northampton, as well as of local engineers, was collected, and tracings made of the various plans. These were sent to the office of the Board, and enlarged or reduced to make them conform to the scale adopted for the surveys. The information thus obtained was useful in locating the property lines, many of which are so marked on the ground as to have been otherwise unascertainable.

Triangulation stations were selected and signals erected on all the main summits included within the area to be surveyed, and such additional ones as were required to give control to the work of the topographic party. These stations were connected by triangulation with the stations established by the town boundary survey. Traverse lines were then run, following the various highways and wood roads around and through the territory, and from these lines the brooks, buildings and other structures were located, and elevations of the various portions of the territory determined.

As the field work progressed, notes were taken and plotted on a series of three plane table sheets, which were later carried into the field with the plane table for the purpose of locating other details which could not be readily reached from the traverse lines. The field work was completed October 25, and the map of the land, on a scale of $\frac{1}{3000}$, finished in the office. In addition to the location of the lots, brooks, buildings and other features, contour lines of elevations at intervals of 20 feet are indicated. After completing the field work a tracing plan was made, showing the outlines of the various properties, and this was used by the real estate experts to assist them in locating the lots. A plan showing all the details of the surveys is appended.

The survey covered an area of about 6½ square miles, 19 triangulation stations having been established, 52.3 miles of traverse lines run, and the elevation of the ground at 4,200 points determined.

The Board, accompanied by its chief engineer and the

engineer in charge of the work, visited the locality and made a careful examination of the existing conditions, walking and driving over such portions of the upland and lowland as would give a good idea of all the territory to be covered and the relations of its several parts. Four qualified experts in land values in that neighborhood were carefully selected, and, with maps in hand, visited all the lots and severally recorded, independently, their estimates of value. The average of their valuations is the basis of the probable cost of acquiring the areas hereinafter referred to.

Between the base of Mt. Tom on the south, Mt. Nonotuck on the north, and the travelled roads at the foot of the mountains on the east and west, lies an area of about 4,000 acres. Of this the city of Holyoke owns 266.3 acres on the south-east slope of Mt. Tom, including Whiting Street reservoir, for the purpose of a partial water supply and the protection of the water-shed adjacent to the lake. Surrounding the city's holdings on the north and west is a wild and partly wooded area, with a picturesque hill and vale surface of about 920 acres, owned by the Holyoke Street Railway Company and the Mt. Tom Railroad Company. This is to-day an attractive park, open to the public, in which certain improvements have been made in sundry places for the purpose of inducing patronage to the railroad company. This tract includes the summit of Mt. Tom, to which the railroad has been carried. There will also be found a refectory, concert hall and a tower of observation, included under one roof. Inasmuch as all this tract is open to public enjoyment, under circumstances and conditions which point to an indefinite continuance of a policy which has created this development for private interest without encouragement from the Commonwealth, no sufficient reason occurs to recommend its acquisition by the Commonwealth or its deprivation from the company now conducting it without cost to the public, who are yet realizing all its opportunities for enjoyment.

The remainder of the tract surveyed contains about 2,892 acres, of which a large portion is peculiarly well adapted for a public reservation. Of these it is believed that the tract

of 1,474.7 acres shown on the annexed plan will provide an ample reservation within the intent of the legislative resolve. Four approaches, 300 feet wide, are shown entering from the highway at convenient points on easy grades to centres especially attractive to the visitor. These approaches are outlined from the main highways through farms at the foot of the ascent, and are sufficiently wide to admit of carriage and foot paths protected by shade trees, and bridle paths if desired. They lead into the most picturesque and beautiful portions of the reservation.

There are bold palisades of some considerable height and grandeur; there are steep slopes and deep valleys, with babbling brooks and cool springs; undulating uplands, with groves of chestnut, oak, hemlock and pine, as well as sprout and and deep tangled wildwood, — in short, every variety of pasture, wood lot and clearing, inviting rest to the weary or affording scope for activity to the restless.

Estimated at their full fair value, on the basis of the averages of the four experts, these 1,474.7 acres ought not to cost the State more than $35,000. If this tract shall be deemed insufficient, it can be increased by additions from the farms on the east bordering on the highway to the extent of some 500 acres. These were not included in the shaded area on the plan, as not being especially attractive for park purposes, and because of being relatively higher in value, owing to the buildings and the location and character of the clearings. A fair estimate of the value of these additional acres on the east side should be about $42,000. The amount expended by the Board from the appropriation of $2,000 will not exceed $1,750.

Town Boundary Survey.

The work of determining the location of the town boundaries has continued with the same organization as last year. Two field parties were at work throughout the season and one additional field party for about six weeks on the town boundary work, with this exception, that one of the field parties, together with the assistant engineer in charge of the work and one draughtsman, were detailed from six to eight

weeks to make the necessary surveys of Mt. Tom and Mt. Nonotuck, required by the provisions of chapter 124 of the Resolves of 1902.

The field parties during the year made surveys and examinations in 36 cities and towns, 16 of these being in Middlesex County, 16 in Norfolk County and 4 in Essex County. In addition to the local surveys at the various boundary monuments, 56 miles of roads and streams where they formed the town boundaries were surveyed. From the notes of these surveys plans will be plotted during the winter, and filed as required by the Statutes.

During the year 7 atlases, covering 20 cities and towns, have been published, and another atlas of the boundary lines of the city of Boston and town of Brookline is now in press. It is proposed to continue this work during the coming year, and, with the data collected during the past season, atlases covering 40 towns can be published. In addition to this work, the examination of the Statutes preparatory to further field work has been carried along, and the necessary information for the field parties for the coming year has been prepared.

Plans of portions of the boundary lines between the city of Marlborough and the town of Southborough, between the towns of Lynnfield and Saugus and between the towns of Carver and Wareham, as established by the Statutes of 1901, have been prepared and filed with the Secretary of State.

A plan for straightening that portion of the boundary line between the towns of Braintree and Holbrook, where it is impossible to determine the location of the original line, has been prepared and sent to the towns interested for their concurrence.

The scheme of publishing in a single atlas the information relating to the boundaries of a group of towns, instead of publishing in one atlas information only relating to a single town, has been continued. The full benefit of the reduction in cost caused by this change will not be obtained before next year, as in a number of cases the atlases published this year contain groups of a small number of towns which were surrounded by towns whose atlases had already been pub-

lished, making it impracticable to include in one atlas as large a number of towns as might otherwise have been consolidated. During the coming year the atlases will contain an average of at least twice as many towns as those published the past year.

State Boundaries.

During the winter the second stone bound was set on the shores of Lake Monomonac, in accordance with the plans stated in the last report of the Board, thus completing the work on the New Hampshire line. A plan showing the location of the new bounds placed near the lake has been made, and a copy of it will be filed with the Secretary of State.

Early in the year a letter was sent to the Governor of Rhode Island, stating that the Board proposed to replace the monuments which had been disturbed in the boundary line between Massachusetts and Rhode Island, and inviting co-operation. A reply was received that the matter would be brought to the attention of the General Assembly. Nothing further, however, having been received, on November 8 a second letter was sent, stating that the Board proposed to set three new stone bounds: One at Ellery Street, between the towns of Wrentham in Massachusetts and Cumberland in Rhode Island, to replace a stone which is too small to properly mark the point and at the present time is so insecurely set as to be easily removed by anyone maliciously inclined. Second, a bound on the westerly line of Canal Street, between the towns of Blackstone in Massachusetts and North Smithfield in Rhode Island. A change is made here because the existing mark at this place, which is buried 4 inches below the surface of the ground, is located on the easterly side of the street, where a bound projecting above the surface would seriously interfere with the use of the adjoining property. Third, a new bound in the line between the towns of Douglas in Massachusetts and Burrillville in Rhode Island, at a point a short distance west of Hemlock Street. This bound is needed to replace a stone too small to properly mark the point, and which at the time of the examination was found to have been pulled from the hole in

which it was set and laid flat on the adjoining land. No answer having been received to this communication, three new bounds were ordered from the same parties who furnished all the bounds used by the Commonwealth to mark the State line. They have been set in the places above described. They are 12 inches square, about 8 feet long, and are lettered "Mass." on one side and "R. I." on the other, with the date 1902, and below, the initial letter of the adjacent town. The setting of these stones completes all the work necessary to put the marking of the Rhode Island line in good condition.

Early in the year a communication was received from the State engineer of New York, inviting co-operation in the perambulation of the boundary line between Massachusetts and New York. As we had perambulated this line a little more than two years previously, it did not seem to the Board that the benefit to be gained by such perambulation would warrant the necessary expense, and a reply to that effect was sent to the engineer of the State of New York, with a statement that, in case he found any of the bounds disturbed, we were prepared to co-operate with him in replacing them. Later in the season a letter was received, stating that the bounds on the line had been found in good condition. At one point the bound was tipped slightly out of the perpendicular, but this was righted, and the marking of the line is now in good condition.

The whole boundary of the Commonwealth is now well and frequently marked by permanent stone and iron bounds, excepting the portion between Massachusetts and Connecticut. The portion of this line west of the Connecticut River was originally laid out in 1803 and the easterly portion in 1826. Comparatively few points are actually marked, and these are not of a permanent character or such as would be set at the present day. An arrangement should be made to re-run and mark this line whenever the State of Connecticut is ready to co-operate.

In the report of the Commission on the Topographical Survey and Map of Massachusetts for 1898, the cost of relocating and marking the Connecticut line was estimated to

be $14,000, of which one-half should be paid by each State. This estimate was based on the cost of the work which had been done in relocating and marking the line between Massachusetts and New York.

Sale of Maps.

Under the provisions of chapter 57 of the Resolves of 1890 the Board has for sale copies of the various atlas sheets of the State map. The edition of a number of these sheets has been exhausted, while in most of them a large stock still remains. Those exhausted are the ones for which there is the greatest demand, and, as the office of the Board is the only place in the State where a large number of maps is kept, the Board has deemed it proper to purchase sheets from the United States Geological Survey at Washington, where the plates are owned, and where they can be procured at the rate of $2 per 100 sheets, while they are sold by the State at the rate of 5 cents each.

Considerable changes have occurred in the topography in various parts of the State, and many of these have been mapped and placed on the engraved copper plates by the Geological Survey, so that the new sheets now printed show the present condition much more nearly than the original sheets.

During the year, under chapter 57 of the Resolves of 1890, 9 atlases, 2 folios and 3,183 additional sheets of the State topographical maps have been sold, for $205.50. Under chapter 360 of the Acts of 1900, 2 town boundary atlases have been sold, for $5. One hundred and seventy-one atlases have been sent to the officers of the various cities and towns, as provided by law. Under chapter 95 of the Resolves of 1891, 86 topographical atlases have been distributed, 83 being sent to free public libraries. The proceeds of the above sales have been paid into the treasury of the Commonwealth.

Wrecks.

Early in February the Boston, Revere Beach & Lynn Railroad Company notified the Board that an obstruction existed in the harbor opposite pier No. 6 of the Grand

Junction wharves at East Boston, directly in the course of the ferry boats of the company, and that the boats had struck it one or more times at low water. Upon examination it was found that a large spud, consisting of four sticks of timber bolted together and with a heavy cast-iron point on the lower end, which had belonged to one of the dredges in the harbor, had been broken off and was standing upright in the location described. This obstruction was removed at the expense of the owner of the spud.

While engaged on this work it was learned that a similar spud had been lost in the same vicinity by another dredge which had been engaged in dredging the main channel of the harbor under the direction of the United States Engineers. The attention of the officer in charge was called to the matter, and on May 12, 1902, notice was received from him that the spud had been found and removed from tide water.

Surveys.

The work done by the engineering department during the year has kept pace with that of previous years. In connection with the improvement of the Commonwealth flats at South Boston, surveys and plans were made for the filling of the area east of the flats already filled, which had previously been enclosed by a sea wall and bulkhead. Plans were also made for the construction of a pile wharf, which has been leased to the Boston Molasses Company, and surveys and plans made for the necessary dredging for docks and approaches to the wharf; also for the necessary drains and for paving the approaches to the lot leased. The necessary laying out and supervision of these various works has also taken a large part of the time of the assistant in charge of work on the flats. The supervision of the dumping of the material dredged from the anchorage basin at Bird Island, the yacht anchorage on the south side of South Boston, the deepening of the channel at the mouth of Charles River, and the dredging on the Commonwealth flats at South Boston, has necessitated the employment of an additional force of dumping inspectors.

In addition to the work above described and that of the

parties engaged on the town boundary survey, the time of one assistant for three months has been occupied in the measurement of the excavated material and the supervision of the work of dredging in South Bay, under contract with John C. Cobb. Another assistant was employed throughout the summer on the supervision of the construction of jetties at the mouth of Bass River and the dredging of a channel through the bar at the mouth of the river.

In December, 1901, surveys were made at Stony Beach, in Hull, and at the Glades Beach, in North Scituate, to determine to what extent the contour of the beaches had been changed by the heavy storms which had occurred about the first of the month.

In January, February, August and October surveys were made over the area dredged at the mouth of Charles River, both before and after the dredging was done. In all, 13,800 soundings were taken on this work.

In January and February surveys were made over the area dredged in the dock on the west side of the Commonwealth pier at South Boston.

In February, March, April and May a survey was made of the flats extending eastward from Jeffries Point, East Boston, to determine their exact elevation and dimensions, for use in the suit brought by the East Boston Company against the Commonwealth to determine the ownership of the flats. In this work 22,770 soundings were taken, and the position of 8 triangulation stations determined.

In February surveys were made to locate the obstruction which it was reported existed off Pier No. 6 of the Grand Junction wharves, East Boston.

In March borings were made in the location of the proposed harbor line at Haverhill, in the vicinity of Haverhill bridge, to determine the depth at which rock was found in this locality.

In March a survey was made to locate the highway on the Glades Beach at North Scituate.

In April a survey was made of Shirley Gut, to determine the extent of the changes which had taken place during the winter, and as a basis for estimating the quantity of material

necessary to be removed from the extremity of Point Shirley to restore the channel to the same condition as in 1901.

In June a survey was made of the dredged channel in West Bay at Osterville.

In June, July and August a survey was made of a portion of Dorchester Bay along the southerly shore of South Boston, preparatory to excavating an anchorage basin, as authorized by chapter 425 of the Acts of 1902. About 1 $\frac{6}{10}$ miles of shore line were surveyed and 10,000 soundings taken over an area of 689 acres.

In July a line of levels was run from the Navy Yard to Jeffries Point at East Boston, to determine the elevation of the tide gauge used in making the survey of the flats extending eastward from Jeffries Point.

In July, August, September and October a survey was made, under the provisions of chapter 124 of the Resolves of 1902, of Mt. Tom and Mt. Nonotuck, as a basis for determining what area would be best suited for a public reservation.

In August and September a survey was made of Cataumet harbor, under the provisions of chapter 71 of the Resolves of 1902.

In September a resurvey of Scorton harbor was made, under the provisions of chapter 130 of the Resolves of 1902. About 1 mile of shore line was surveyed and 2,138 soundings taken over an area of about 75 acres.

In October and November a survey was made over the area dredged in South Bay, to determine the extent to which the contract requirements had been executed.

In November a hydrographic survey of a portion of Mystic River between Chelsea and Malden bridges was made, and on November 12 a hydrographic survey of a portion of Malden River from its mouth to the wharf of the United States Steel Company.

INSPECTIONS MADE BY THE BOARD DURING THE YEAR.

1901.

Dec. 31. Plant of New England Sanitary Product Company at the Calf Pasture, Old Harbor Point.

1902.

Feb. 15. Mary's Pond at Rochester, relative to petition for license to draw water from this pond for flowing cranberry bogs.

Feb. 20. Reserved Channel and portion of Commonwealth flats at South Boston, in company with legislative committee.

Feb. 25–26. Herring River at West Harwich, and East and West bays at Osterville, in company with legislative committee.

Mar. 18. Wharf of Standard Oil Company of New York on Chelsea Creek at East Boston, relative to proposed extension.

Mar. 20. Boston harbor, in company with legislative committee.

Mar. 25–26. Bass River at South Yarmouth, relative to work authorized by chapter 113 of the Acts of 1901 and chapter 174 of the Acts of 1902.

Apr. 18–19. Work done on jetties at Bass River in South Yarmouth, under direction of the Board.

May 2. Mary's Pond in Rochester, also Blackmore's Pond at South Wareham, relative to petitions for licenses to draw water from these ponds for flowing cranberry bogs.

May 5–7. Province Lands at Provincetown, Scorton harbor at East Sandwich, jetties at Menamsha Inlet, site of proposed breakwater in Apponagansett harbor at South Dartmouth, — in company with legislative committee.

May 6. Work done on jetties at Bass River in South Yarmouth.

May 9. Work done on sea wall and jetties at Stony Beach in Hull, under direction of the Board.

May 12–13. Work done on jetties at Bass River in South Yarmouth.

May 15–17. Work done on sea wall at North Scituate; also work done on sea wall and jetties at Stony Beach in Hull.

1902.

May 20. Commonwealth pier at South Boston, and other terminal points in Boston harbor, in company with the dock commissioners of New York and others.

May 23. New Bedford and Fairhaven bridge.

May 28–29. Work done on sea wall at North Scituate; also work done on sea wall and jetties at Stony Beach in Hull.

June 2. Protective work in progress on the bank of the Connecticut River in Hadley, under direction of the Board.

June 4. Work done by the Roxbury Central wharf in South Bay.

June 6–7. Work done on jetties at Bass River in South Yarmouth.

June 10. Southerly shore of South Boston, relative to dredging authorized by chapter 425 of the Acts of 1902.

June 13–16. Nantucket harbor, relative to removal of certain rocks; Lake Anthony at Cottage City, relative to further improvement; sites of proposed wharf structures in Edgartown harbor.

June 21. Protective work in progress on the bank of the Connecticut River in Hadley.

June 24–25. Work done on sea wall at North Scituate and on sea wall and jetties at Stony Beach in Hull.

July 1–2. Work done on sea wall at North Scituate, and on sea wall and jetties at Stony Beach in Hull; wharf of Samuel James, 2d, and others, in Hull.

July 3. Wharf of F. L. Young, at foot of P Street, South Boston.

July 5–6. West Bay at Osterville; also work done on jetties at Bass River in South Yarmouth.

July 15. Work done on sea wall and jetties at Stony Beach in Hull.

July 21–22. Work done on jetties at Bass River.

July 23–25. Mt. Tom and Mt. Nonotuck, relative to survey authorized by chapter 124 of the Resolves of 1902.

July 29. Site of proposed wharf of Trustees of White Head Association on Weir River in Hull.

Aug. 1–2. Work done on jetties at Bass River.

1902.

Aug. 4-6. Dredging in progress at Lake Anthony in Cottage City; Menamsha Inlet, relative to proposed work.

Aug. 10–11. Apponagansett harbor, relative to work authorized by chapter 509 of the Acts of 1902.

Aug. 22. Work done on jetties at Bass River.

Aug. 25–26. Cataumet harbor, relative to survey provided for by chapter 71 of the Resolves of 1902.

Aug. 28. Wharves of Messrs. Richards, Stone, Ginn and others, on Mystic River; also work done by the Boston & Maine Railroad on Millers River.

Aug. 28 29. Protective work in progress on bank of Connecticut River in Hadley; work in progress on survey of Mt. Tom and Mt. Nonotuck.

Sept. 5–6. Work done on jetties at Bass River.

Sept. 13. Beaches in Marblehead, relative to a petition of the selectmen for authority to remove material.

Sept. 18–19. Work done on jetties at Bass River.

Sept. 20–22. Protective work in progress on bank of Connecticut River in Hadley; work in progress on survey of Mt. Tom and Mt. Nonotuck.

Sept. 23. Nantasket Beach and other portions of the shore in Hull.

Sept. 25–27. New Bedford and Fairhaven bridge; cause of complaint by the Union Street Railway Company; also work in progress at Apponagansett harbor, Lake Anthony and Bass River, and work done by the Commonwealth at Osterville.

Oct. 6. Work done on jetties at Bass River.

Oct. 7–8. Work in progress at Lake Anthony; also jetties at Menamsha Inlet.

Oct. 23. Merrimac River from Haverhill to Lowell, in the matter of determining the advisability of opening the river to navigation from Lowell to the sea.

Oct. 30. Work in progress on the Commonwealth flats.

Nov. 5–6. Mt. Tom and Mt. Nonotuck, relative to State reservation.

Licenses granted during the Year.

Nos.

2559. Petition of the New England Structural Company for license to build a pile wharf and drive piles for the support of a building on Island End River, in Everett. Granted Dec. 30, 1901.

Nos.

2560. Petition of the town of Plymouth for license to build and maintain three sewer outlets in Plymouth harbor. Granted Dec. 30, 1901.

2561. Petition of Adelaide L. Taft for license to build and maintain a pile pier and float in Buttermilk Bay, in Bourne. Granted Dec. 30, 1901.

2562. Petition of the Commercial Wharf Company for license to drive additional piles at the south pier of Commercial wharf in Boston harbor, in Boston. Granted Dec. 30, 1901.

2563. Petition of the Boston Yacht Club for license to extend its wharf, on piles, in Marblehead harbor, in Marblehead. Granted Dec. 30, 1091.

2564. Petition of Mary L. Goldthwait for license to extend her wharf, on piles, in Marblehead harbor, in Marblehead. Granted Dec. 30, 1901.

2565. Petition of Robert C. Hooper for license to build and maintain an iron and timber pier and a float, in Manchester harbor at Chubbs Point, in Manchester. Granted Jan. 1, 1902.

2566. Petition of Charles Maurais for license to maintain a sea wall and filling in Salem harbor, in Salem. Granted Jan. 6, 1902.

2567. Petition of Joseph O. Boucher for license to maintain a sea wall and filling in Salem harbor, in Salem. Granted Jan. 6, 1902.

2568. Petition of Edmond Leclere for license to maintain a sea wall and filling in Salem harbor, in Salem. Granted Jan. 6, 1902.

2569. Petition of Edmond Leveille for license to maintain a sea wall and filling in Salem harbor, in Salem. Granted Jan. 6, 1902.

2570. Petition of James C. Chalifour for license to maintain a sea wall and fill solid in Salem harbor, in Salem. Granted Jan. 6, 1902.

2571. Petition of Richard A. Everson for license to maintain flumes and draw water from Maquan Pond, in Hanson. Granted Jan. 6, 1902.

2572. Petition of Warren S. Bumpus for license to excavate a canal, build a flume and draw water from Clear Pond, in Plymouth. Granted Jan. 6, 1902.

2573. Petition of the Board of Park Commissioners of Boston for license to fill solid in Dorchester Bay. Granted Jan. 6, 1902.

Nos.

2574. Petition of the city of Boston for approval of plans for rebuilding Broadway bridge across Fort Point Channel, as authorized by chapter 452 of the Acts of 1900. Granted Jan. 6, 1902.

2575. Petition of the New England Sanitary Product Company for license to build a pile wharf and sea wall, to fill solid and dredge at Spectacle Island in Boston harbor. Granted Jan. 6, 1902.

2576. Petition of the Boston, Cape Cod & New York Canal Company for approval of plans for the construction of two stone jetties in Barnstable Bay, in Sandwich, under authority of chapter 448 of the Acts of 1899. Granted Jan. 28, 1902.

2577. Petition of Walter O. Luscombe for license to build a sea wall and fill solid, and to maintain a wharf already built, in Great Harbor at Woods Hole, in Falmouth. Granted Jan. 28, 1902.

2578. Petition of Joan E. Swift for license to build a sea wall and fill solid in Great Harbor at Woods Hole, in Falmouth. Granted Jan. 28, 1902.

2579. Petition of James E. Rothwell for license to build a sea wall and jetties, and to fill solid, in Cotuit harbor, in Barnstable. Granted Jan. 29, 1902.

2580. Petition of William F. Stanley and W. Wallace Benjamin for license to lay a pipe, build a pumping station and flume and draw water from Dunham Pond, in Carver. Granted Feb. 5, 1902.

2581. Petition of George H. Hood for license to build and maintain a pier in Manchester harbor, in Manchester. Granted Feb. 10, 1902.

2582. Petition of the New England Railroad Company for license to drive piles and build a structure for the support of an interlocking tower in South Bay, in Boston. Granted Feb. 17, 1902.

2583. Petition of Sarah B. Fay for license to maintain a wharf, walls, filling and marine railway in Little Harbor at Woods Hole, in Falmouth. Granted Feb. 17, 1902.

2584. Petition of the Boston Elevated Railway Company for license to build a sea wall and concrete piers, fill solid, widen its wharf on piles, and dredge, in Boston harbor at Lincoln wharf, in Boston. Granted Feb. 17, 1902.

Nos.

2585. Petition of Joseph W. Stickney for license to build a bulkhead and fill solid on Chelsea Creek, in Chelsea. Granted Feb. 17, 1902.

2586. Petition of Frank G. Burke for license to build and maintain a pile pier in Edgartown harbor. Granted Feb. 17, 1902.

2587. Petition of the Magee Furnace Company for license to fill solid on Chelsea Creek, in Chelsea. Granted Feb. 17, 1902.

2588. Petition of Stephen J. Connolly, Gregory P. Connolly and Thomas D. Connolly for license to rebuild their wharf, on piles, in Manchester harbor, in Manchester. Granted Feb. 17, 1902.

2589. Petition of Samuel Knight for license to widen his wharf, on piles, in Manchester harbor, in Manchester. Granted Feb. 17, 1902.

2590. Petition of the New England Telephone and Telegraph Company of Massachusetts for license to drive piles in Boston harbor at the South Ferry in East Boston for the support of a conduit and cable box. Granted Feb. 17, 1902.

2591. Petition of Clementine G. Ricketson for license to build and maintain a stone pier and float in Apponagansett harbor at Ricketson's Point, in Dartmouth. Granted Feb. 17, 1902.

2592. Petition of the city of Boston for license to repair the piers of Dover Street bridge on Fort Point Channel. Granted Feb. 24, 1902.

2593. Petition of Richard T. Green and John C. Harrington for license to build a pile wharf and marine railway and to dredge, on Chelsea Creek, in Chelsea. Granted Feb. 24, 1902.

2594. Petition of Walter Baker & Co., Limited, for license to build a foundation wall and a building in and over Neponset River, westerly of the foot bridge of said company in Milton. Granted Feb. 24, 1902.

2595. Petition of Leroy S. Johnson for license to fill solid in South Bay, at his wharf adjoining Albany Street in Boston. Granted Feb. 27, 1902.

2596. Petition of the Edison Electric Illuminating Company of Boston for license to build a bulkhead and fill solid near the Reserved Channel at South Boston. Granted March 7, 1902.

Nos.

2597. Petition of the trustees of Salem Hospital for license to build a bulkhead and fill solid on South River, in Salem. Granted March 26, 1902.

2598. Petition of the Philadelphia & Reading Coal and Iron Company for license to drive piles at its wharf on Acushnet River, in New Bedford. Granted March 26, 1902.

2599. Petition of George B. Cudworth for license to rebuild his wharf on Assonet River, in Freetown. Granted March 26, 1902.

2600. Petition of the city of Boston for approval of plans for the construction of a bridge over Fort Point Channel, in the extension of Atlantic Avenue, as authorized and required by chapter 466 of the Acts of 1899. Granted March 26, 1902.

2601. Petition of Henry H. Fay for license to extend his wharf, on piles, in Great Harbor at Woods Hole, in Falmouth. Granted March 26, 1902.

2602. Petition of Daniel Crosby & Son for license to build and maintain a pile pier and launching ways in North Bay at Osterville, in Barnstable. Granted March 26, 1902.

2603. Petition of the city of Boston for license to drive piles at Malden bridge on Mystic River. Granted March 28, 1902.

2604. Petition of the Metropolitan Water and Sewerage Board for approval of plans for the construction of a pile wharf in Boston harbor on the southerly side of Deer Island, for the support of a water pipe, under authority of chapter 439 of the Acts of 1889. Granted March 28, 1902.

2605. Petition of Austin Ford & Son for license to build a sea wall and fill solid on Broad Canal, in Cambridge. Granted March 31, 1902.

2606. Petition of Mrs. Charles I. Gibbs for license to maintain a pier in Mattapoisett harbor, in Mattapoisett. Granted April 2, 1902.

2607. Petition of the Board of Public Works of New Bedford for license to extend Coffin Avenue sewer, build a retaining wall and fill solid on Acushnet River, in New Bedford. Granted April 4, 1902.

2608. Petition of the New Bedford Yacht Club for license to build and maintain a temporary pile pier and float in Padanaram harbor, in Dartmouth. Granted April 4, 1902.

Nos.

2609. Petition of W. Harry Brown for license to maintain a breakwater in Buzzards Bay, and a boathouse and float in Great Harbor at Woods Hole, in Falmouth. Granted April 4, 1902.

2610. Petition of the Board of Metropolitan Park Commissioners for approval of plans for the construction of a pile bridge and approaches across Mystic River between Somerville and Medford, as authorized and directed by chapter 491 of the Acts of 1901. Granted April 11, 1902.

2611. Petition of Albert J. West for license to build and maintain a boat landing and excavate a channel, in Hull Bay at Park Island. Granted April 11, 1902.

2612. Petition of the Boston & Maine Railroad for license to fill flats and build a pile platform on Mystic River, in Somerville. Granted April 25, 1902.

2613. Petition of Joseph Stone for license to fill solid on Mystic River, in Boston. Granted April 25, 1902.

2614. Petition of the Fall River Iron Works Company for license to build a sea wall and fill solid on Taunton River, in Fall River. Granted April 25, 1902.

2615. Petition of the Chequaquett Club for license to build and maintain a pile pier in Centreville harbor, in Barnstable. Granted May 2, 1902.

2616. Petition of the city of Salem for approval of plans for laying a pipe in Salem harbor, for the purpose of sewage disposal authorized by chapter 353 of the Acts of 1901. Granted May 6, 1902.

2617. Petition of Benjamin F. Vose for license to lay a pipe, construct a flume and draw water from Marys Pond, in Rochester. Granted May 9, 1902.

2618. Petition of the State Wharf and Storage Company for license to build a pile wharf in Boston harbor, at East Boston. Granted May 9, 1902.

2619. Petition of H. E. Crandell for license to build and maintain a wharf and float in Lake Quinsigamond, in Worcester. Granted May 13, 1902.

2621. Petition of Eugene S. Morse for license to build a sea wall and fill solid in a dock on the south channel of Mystic River, in Boston. Granted May 13, 1902.

2622. Petition of Louis Curtis and Charles F. Adams, 2d, trustees, for license to build a sea wall and fill solid in a dock on the south channel of Mystic River, in Boston. Granted May 13, 1902.

Nos.

2623. Petition of the town of Essex for approval of plans for reconstructing the bridge over Essex River in the village of Essex, as authorized by chapter 119 of the Acts of 1902. Granted May 15, 1902.

2624. Petition of Thomas Lahey for license to build a temporary pile wharf on Belle Isle Inlet, in Winthrop. Granted May 19, 1902.

2625. Petition of W. S. Lowe & Co. for license to build a pile wharf on Merrimac River, in Haverhill. Granted May 19, 1902.

2626. Petition of Joseph S. Bigelow for license to build and maintain a boat landing and float in Cohasset harbor, in Cohasset. Granted May 22, 1902.

2627. Petition of Elmore E. Locke, for license to build a bulkhead and pile wharf and fill solid on Malden River, in Malden. Granted May 22, 1902.

2628. Petition of the Whitman Mills for license to build a bulkhead and fill solid on Acushnet River, in New Bedford. Granted May 22, 1902.

2629. Petition of the Young Men's Christian Association for license to build and maintain a wharf and float in Lake Quinsigamond, in Worcester. Granted May 29, 1902.

2630. Petition of West's Beach Corporation for license to maintain a pier and floats in Salem harbor, in Beverly. Granted June 10, 1902.

2631. Petition of Joseph C. Nowell for license to build and maintain a wharf in Apponagansett harbor, in Dartmouth. Granted June 10, 1902.

2632. Petition of the Middleborough, Wareham & Buzzards Bay Street Railway Company for license to build and maintain a pile bridge across Monument River, in Bourne. Granted June 10, 1902.

2633. Petition of Oliver C. Lumbert for license to build and maintain a bulkhead and jetties in Cotuit harbor, in Barnstable. Granted June 10, 1902.

2634. Petition of Isaiah Spindell for license to maintain a sea wall and filling and to extend the same in Great Harbor at Woods Hole, in Falmouth. Granted June 26, 1902.

2635. Petition of Herbert F. Whiting for license to build and maintain a boat landing in Great South Pond, in Plymouth. Granted June 26, 1902.

Nos.

2636. Petition of William L. Henry for license to build and maintain a pile pier on Bass River, in Yarmouth. Granted June 26, 1902.

2637. Petition of Abraham Osborn for license to build and maintain a pile pier in Edgartown harbor. Granted June 26, 1902.

2638. Petition of the city of Fall River for license to extend a sewer in Riverview Street into Mount Hope Bay. Granted July 1, 1902.

2639. Petition of Alla M. Raymond for license to build and maintain a pile pier and float in Salem harbor, in Marblehead. Granted July 8, 1902.

2640. Petition of the Fall River Iron Works Company for license to build a sea wall and fill solid on Taunton River, in Fall River. Granted July 15, 1902.

2641. Petition of the town of Plymouth for license to build and maintain a sewer outlet in Plymouth harbor. Granted July 17, 1902.

2642. Petition of William F. Nye for license to maintain a pile wharf as now built and to extend the same in New Bedford harbor at Fish Island, in New Bedford. Granted July 17, 1902.

2643. Petition of Joseph H. Beale for license to extend a pier, on piles, and to locate and maintain a float, in Barnstable harbor, in Barnstable. Granted July 18, 1902.

2644. Petition of D. H. Craig for license to extend his wharf in Plymouth harbor, in Plymouth. Granted July 18, 1902.

2645. Petition of Alvarado A. Coburn for license to build and maintain a wharf and float in Lake Quinsigamond at Lincoln Park, in Worcester. Granted July 18, 1902.

2646. Petition of the Roxbury Central Wharf for license to construct wharves and docks and fill land and flats in South Bay, in Boston. Granted July 22, 1902.

2647. Petition of the South Bay Wharf and Terminal Company for license to fill land and flats in South Bay, in Boston. Granted July 22, 1902.

2648. Petition of the city of Fall River for approval of plans for the construction of a stone arch bridge and other work on Taunton River, in connection with the abolition of grade crossings in Fall River authorized by chapter 472 of the Acts of 1900. Granted Aug. 1, 1902.

Nos.

2649. Petition of Lester Leland for license to lay and maintain a pipe drain in Black Cove, in Manchester. Granted Aug. 4, 1902.

2650. Petition of William M. Butler for license to extend a wharf, on piles, in Edgartown harbor. Granted Aug. 5, 1902.

2651. Petition of Frances C. Lillie for license to build a pile wharf in Buzzards Bay at Woods Hole, in Falmouth. Granted Aug. 5, 1902.

2652. Petition of the city of Taunton for license to build a sea wall and rebuild its wharf on Taunton River. Granted Sept. 16, 1902.

2653. Petition of George Lowell Tracy and Augustus Tirrell for license to build and maintain a sea wall, pile pier and float on Weymouth Fore River, in Weymouth. Granted Sept. 16, 1902.

2654. Petition of William A. Keyes for license to excavate a channel, build a flume and draw water from Blackmore's Pond, in Wareham. Granted Sept. 16, 1902.

2655. Petition of Alvarado A. Coburn for license to maintain two wharves and two floats in Lake Whalom at Whalom Park, in Lunenburg. Granted Sept. 16, 1902.

2656. Petition of John D. Dickinson for license to build and maintain a boat house and pier, on piles, in Edgartown harbor. Granted Sept. 25, 1902.

2657. Petition of Clarence M. Nash and James L. Barnes for license to build and maintain a pier in Lake Chaubunagungamaug at Wawela Park, in Webster. Granted Sept. 25, 1902.

2658. Petition of Edmund D. Codman and Joseph B. Russell, trustees, for license to fill solid and drive piles at Lovejoy's wharf on Charles River, in Boston. Granted Sept. 29, 1902.

2659. Petition of Charles L. Eaton for license to build and maintain a sea wall in Massachusetts Bay at Clifton, in Marblehead. Granted Sept. 29, 1902.

2660. Petition of Edward C. Battis for license to build a bulkhead and fill solid in a dock on South River, in Salem. Granted Oct. 2, 1902.

2661. Petition of George H. Richards and Howard Stockton, trustees of the Toby Club, for license to build and maintain a stone and pile pier, float and marine railway in Pocasset harbor, in Bourne. Granted Oct. 2, 1902.

Nos.

2662. Petition of Lester N. Godfrey and others for license to build a sea wall and fill solid on Neponset River, in Milton. Granted Oct. 7, 1902.

2663. Petition of the New England Cotton Yarn Company for license to build a bulkhead, drive piles, fill solid and erect a building on Acushnet River, in New Bedford. Granted Oct. 10, 1902.

2664. Petition of the Boston & Maine Railroad for license to build a temporary drawbridge, on piles, across Millers River, in Boston and Cambridge. Granted Oct. 31, 1902.

2665. Petition of the city of Boston for license to repair and build an addition to its wharf on the easterly side of Long Island in Boston harbor. Granted Oct. 31, 1902.

2666. Petition of the New Bedford Gas and Edison Light Company for license to build a pile wharf on Acushnet River, in New Bedford. Granted Oct. 31, 1902.

2667. Petition of Francis C. Foster for license to maintain a wharf in Little Harbor at Woods Hole, in Falmouth. Granted Oct. 31, 1902.

2668. Petition of Moses Williams and others for license to build a dam across Cedar Pond Creek, in Bourne. Granted Nov. 10, 1902.

2669. Petition of the Butler Mill for license to lay and maintain pipes, build a crib and to dredge on Acushnet River, in New Bedford. Granted Nov. 10, 1902.

2670. Petition of Robert W. Emmons, 2d, and others for license to build a private road in Buzzards Bay at Toby Island, in Bourne. Granted Nov. 11, 1902.

2671. Petition of Robert W. Emmons, 2d, and others for license to build a boat landing in Buzzards Bay on the northerly side of Toby Island, in Bourne. Granted Nov. 11, 1902.

2672. Petition of the New England Sanitary Product Company for license to construct and maintain two dolphins in Boston harbor northerly of and near the wharf of said company at Spectacle Island. Granted Nov. 11, 1902.

2673. Petition of Samuel G. Irwin for license to rebuild a portion of his present wharf, on piles, and to widen the same, on piles, in Crystal Cove, in Winthrop. Granted Nov. 18, 1902.

2674. Petition of Samuel James, 2d, and others for license to extend their wharf in Hull Bay, in Hull. Granted Nov. 18, 1902.

Nos.

2675. Petition of Harrison Mitchell for license to build a wharf in Hull Bay adjoining Nantasket Avenue, in Hull. Granted Nov. 18, 1902.

2676. Petition of Elias P. Morton for license to build and maintain two wharves in Lake Chaubunagungamaug at Idler's Bluff, in Webster. Granted Nov. 18, 1902.

2677. Petition of William J. Sullivan for license to fill solid in South Bay, northerly of Massachusetts Avenue and westerly of the Midland Division of the New York, New Haven & Hartford Railroad, in Boston. Granted Nov. 18, 1902.

2678. Petition of Alexander C. Adams for license to build a pile and timber jetty in Cotuit Bay, in Barnstable. Granted Nov. 19, 1902.

2679. Petition of the city of Boston for license to dump snow and ice into tide waters. Granted Nov. 19, 1902.

2680. Petition of the Boston Elevated Railway Company for license to dump snow and ice into tide waters. Granted Nov. 19, 1902.

2681. Petition of the Union Freight Railroad Company for license to dump snow and ice into Charles River from the yard of the Fitchburg Railroad Company at the foot of Haverhill Street, in Boston. Granted Nov. 19, 1902.

2682. Petition of Ada J. Gould for license to build and maintain a pile pier and float in Stage harbor, in Chatham. Granted Nov. 19, 1902.

2683. Petition of Allen F. Keith for license to build a wharf in Hull Bay adjoining Nantasket Avenue, in Hull. Granted Nov. 19, 1902.

2684. Petition of Sophia M. Luce for license to build a sea wall and fill solid in Sippican harbor, in Marion. Granted Nov. 21, 1902.

2685. Petition of Harvey W. Everest for license to build a sea wall and fill solid in Sippican harbor, in Marion. Granted Nov. 21, 1902.

2686. Petition of Margarethe E. Dreyer for license to build a sea wall and fill solid in Sippican harbor, in Marion. Granted Nov. 21, 1902.

2687. Petition of Maurice H. Richardson for license to build a sea wall and fill solid in Sippican harbor, in Marion. Granted Nov. 21, 1902.

Petitions denied.

On April 24, 1901, a hearing was given on the petition of Nelson H. Seelye to legalize a structure purporting to have been built under a license granted Dec. 26, 1889, which, however, had not been recorded. It appeared that the structure was not built in accordance with the plans accompanying the license. The petition was opposed by adjoining owners, on the ground that it failed to conform to the requirements of the license and tended to impair their right of ingress and egress to their wharves. After several hearings and postponements for the convenience of the parties interested, on March 7, 1902, the Board gave the petitioners leave to withdraw.

On September 15 the Board declined to grant a permit to the selectmen of Marblehead to remove material from the southerly side of the causeway leading from Marblehead to Marblehead Neck, on the ground that the Fifty-seventh Congress at its first session authorized a survey and estimate of cost of a breakwater with a view to protecting said causeway from injury by the sea; consequently the Board could not approve any action which would tend to weaken the existing protection.

On Sept. 29, 1902, after a hearing at which remonstrants appeared in person and by counsel, the Board declined to grant a license to the city of Cambridge to build a bridge across Lechmere Canal on the plans as filed. The grounds of objection were that the tide waters over which the city had laid out a highway and planned to construct a bridge were within a public cove, not in a location above a lawful bridge in which no draw actually exists; and consequently the proposal of the city was in violation of the provisions of chapter 96, section 17, of the Revised Laws; and, further, it was objected that the city had failed to show any authority in law to justify the act of laying out a highway that encroached upon tide waters. Without questioning the right of the city to determine whether public necessity and convenience demanded the building of the proposed highway, the Board adjudged the objections of the remonstrants to be

well founded, and that ampler powers must be obtained by the city from the Legislature before the Board could take further action.

MISCELLANEOUS PERMITS GRANTED DURING THE YEAR.

JOSEPH L. BOARDMAN, to remove gravel from Salter's Beach, in Plymouth. Granted Jan. 28, 1902.

EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON, to erect a temporary building on Batchelders wharf, so called, on Fort Point Channel, in Boston. Granted Feb. 19, 1902.

TRUSTEES OF THE MAIN STREET LAND TRUST, to dredge material from Charles River on the Cambridge side of the channel near West Boston bridge. Granted Feb. 26, 1902.

JEREMIAH O'RIORDEN, to dredge a channel leading from the main channel in Weymouth Back River, and to dump the dredged material near the shore line of said river. Granted April 1, 1902.

PARK COMMISSIONERS OF MARBLEHEAD, to take stone for paving purposes from Hines' Beach and Ballast Beach, in Marblehead. Granted April 11, 1902.

ROWE BROTHERS COMPANY, to dredge material from Merrimac River. Granted May 5, 1902.

C. M. COLE, to dump material dredged from Hog Island harbor at West Falmouth, in Buzzards Bay. Granted May 16, 1902.

J. K. GANNETT, Jr., to remove gravel from North Scituate Beach, in Scituate. Granted May 26, 1902.

LOUIS T. CUSHING, to remove gravel from Collier's Beach, in Scituate. Granted June 24, 1902.

MARBLEHEAD CEMETERY COMMISSIONERS, to take stone for paving purposes from Ballast Beach, in Marblehead. Granted Sept. 18, 1902.

P. J. MULLIN & CO., and J. C. MURPHY, to construct three dolphins in Boston harbor near the Reserved Channel at South Boston. Granted Sept. 25, 1902.

NEW ENGLAND DREDGING COMPANY, to dredge material at Shirley Gut, in Boston harbor. Granted Sept. 25, 1902.

NEW ENGLAND DREDGING COMPANY, to use for storage purposes a portion of the Commonwealth flats at South Boston on the northerly side of the Reserved Channel. Granted Sept. 25, 1902.

JEREMIAH O'RIORDEN, to dredge material at Shirley Gut, in Boston harbor. Granted Sept. 25, 1902.

American Agricultural Chemical Company, to dredge in Weymouth Back River and to dump the material in Lower Neck Cove, in Weymouth. Granted Oct. 3, 1902.

Metropolitan Park Commissioners, to remove sand above high-water mark and between high and low water marks within the limits of the Nantasket Beach reservation. Granted Oct. 7, 1902.

Charles M. Cole, to dump material dredged in New Bedford harbor, at North Ledge in said harbor. Granted Nov. 19, 1902.

Nantasket Beach Steamboat Company, to remove accumulations of sand in the berths and around Pemberton pier, in Hull. Granted Nov. 19, 1902.

Work of the United States in Rivers and Harbors of the Commonwealth.

The Board is indebted to Lieut.-Col. W. S. Stanton and Capt. Harry Taylor, Corps of Engineers, U. S. A., who are in charge of river and harbor improvements in eastern Massachusetts, and Maj. Geo. W. Goethals, Corps of Engineers, U. S. A., who is in charge of similar work in southern Massachusetts, for the following statements, which show the work accomplished in the rivers and harbors of this Commonwealth during the fiscal year ending June 30, 1902: —

Statement of Lieut.-Col. W. S. Stanton, Corps of Engineers, U. S. A.

Boston, Mass., Nov. 24, 1902.

Board of Harbor and Land Commissioners, Commonwealth of Massachusetts, State House, Boston, Mass.

Sirs: — In accordance with your request of Nov. 17, 1902, I have the honor to furnish the following summary of work done by the United States during the fiscal year that closed June 30, 1902, in the rivers and harbors in my district in Massachusetts: —

The works of improvement under my charge on June 30, 1902, were: —

1. Lynn harbor,
2. Boston harbor,
3. Chelsea Creek,
4. Mystic River,
5. Malden River,
6. Charles River,
7. Weymouth River,
8. Town River,
9. Cohasset harbor,
10. Scituate harbor,
11. Duxbury harbor,
12. Plymouth harbor,
13. Provincetown harbor,
14. Chatham harbor,
15. Removal of wrecks.

Boston Harbor.

The entire repointing of the sea walls on Great Brewster Island and at Point Allerton, 4,042 feet in length, was completed. On Deer Island the sea wall at the middle head, a large part of which was demolished by the storms of 1898, was rebuilt, and the rebuilding of the wall at the north head was commenced.

In the main ship channel, at the upper middle, 388,384.5 cubic yards were dredged, mostly of clay, substantially completing the dredging to deepen the main ship channel (upper and lower) to 27 feet at mean low water and widen it to 1,000 feet, with the exception of some scattering shoals, which remain to be removed to obtain that depth in fulfillment of the requirements of the contract.

In the upper main ship channel a contract for the excavation of 3,446 cubic yards of rock was completed, and 99 small points of ledge were also removed, obtaining a channel through the ledges at the upper middle 27 feet deep and 500 feet wide.

In the Broad Sound Channel, under the project adopted by the act of March 3, 1899, to obtain a channel 30 feet deep at mean low water and 1,200 feet wide, 380,844 cubic yards of hard pan, clay, gravel, sand and boulders were dredged, obtaining a channel 1,000 feet in width and 30 feet in depth, excepting some shoal places on Devil's Back at the ocean end of the channel.

Chelsea Creek.

Thirteen thousand, two hundred and fifty-five cubic yards of mud were dredged, extending the channel 75 feet wide and 18 feet deep at mean high water to a point opposite the works of the Revere Rubber Company, and widening the channel 14 feet deep at mean high water, thence to Proctor's wharf, to 50 to 150 feet.

Scituate Harbor.

Two thousand, eight hundred and eighty-seven cubic yards of gravel and beach shingle were dredged, completing the removal of a shoal that had encroached upon the dredged channel near the wharves.

Plymouth Harbor.

On Long Beach 6,526.5 linear feet of riprap dike were built, containing 13,728 tons of stone, completing the building of the dike, 10,468 feet long, authorized by the act of March 3, 1899.

Provincetown Harbor.

On the beach and sand dunes southerly from Abel Hill Dike 314 linear feet of dike of timber and sand, 737 linear feet of plank bulkhead, 2,100 linear feet of groins and 9,486 linear feet of low sand-catching fences were built. The bulkheads prevented an inroad by the sea into the harbor which was threatened by the storms of November to March.

Chatham Harbor.

On the three bars at the entrance to this harbor from Chatham Roads 16,599 cubic yards of sand were dredged, making channels 200 feet wide through the outer bar, 150 feet wide through the middle bar, and 100 feet wide through the inner bar, — all 6 feet deep at mean low water.

Removal of Wrecks.

Parts of the hulls of the schooners "Ira Laffrinier" and "Mondego" were removed from Nauset harbor.

Because funds were not available, no work was done in Lynn harbor, Mystic River, Malden River, Charles River, Weymouth River, Town River, Cohasset harbor and Duxbury harbor, Mass.

Very respectfully, W. S. Stanton,
Lieutenant-Colonel, Corps of Engineers.

Statement of Capt. Harry Taylor, Corps of Engineers, U. S. A.

Boston, Mass., Nov. 19, 1902.

Board of Harbor and Land Commissioners, State House, Boston, Mass.

Gentlemen: — In accordance with request contained in your letter of the 17th instant, I have the honor to furnish the following summary of the work done by the United States during the fiscal year ending June 30, 1902, in the rivers and harbors of Massachusetts under the charge of this office: —

Newburyport Harbor.

During the past fiscal year no operations were in progress other than the removal of "North Rock" and the resetting of the beacon on the end of the north jetty. This beacon, which was displaced some time ago by severe storms, was reset during June, 1902, and about 100 tons of heavy stone placed around it for its protection.

The sum of $30,000 was appropriated by the act of June 13,

1902, for continuing this improvement. These funds will be applied toward the extension of the south jetty and to such repairs as may be necessary to both jetties.

Merrimac River.

The present approved project for the improvement of this river provides for a channel 150 wide and 7 feet deep at mean low water (ordinary low-water stage of the river) from Newburyport to Haverhill. The first work under this project was begun in 1901, and at the close of the fiscal year ending June 30, 1901, a total of 4,792 cubic yards of material had been removed. During the past fiscal year dredging was continued, a total of 64,356 cubic yards of material being taken out during the year, exclusive of 2,572 cubic yards of boulders removed. The work thus far done has completed the 150 foot channel to the full depth and width for a distance of about 1½ miles from Haverhill down river.

The river and harbor act of June 13, 1902, appropriated $40,000 for the continuation of this work, and directed an examination to be made of the river, with a view to obtaining a depth of 9 feet to Haverhill.

Harbor of Refuge, at Sandy Bay, Cape Ann, Mass.

During the fiscal year operations have been continued on the construction of the substructure of the breakwater, a total of 113,202 tons of rubblestone having been placed in it during the year. A small part of this stone was placed in the southern arm, to raise low places where the substructure had been beaten down by the sea. The substructure of the southern arm of the breakwater is completed to mean low water, except for a distance of about 70 feet. Most of the work during the year was applied to the extension of the western arm, which was raised to elevation —12 for a distance of 400 feet from the angle at Abner's Ledge, and a core of the superstructure was built on this 400 foot section up to mean high water, 12 feet wide on top.

The river and harbor act of June 13, 1902, appropriated $200,000 for continuing this improvement.

Rockport Harbor.

No work has been done on this harbor since 1847, when two breakwaters were built at the mouth of the harbor. Since that time these breakwaters have so far deteriorated by the action of the sea that they fail to effect the purpose for which they were built.

The river and harbor act of June 13, 1902, appropriated $22,000 for rebuilding the breakwaters to a height of about 10 feet above high water with heavy rubblestone, and for the removal of the principal rocks in the harbor.

Gloucester Harbor.

No operations were in progress on this work during the fiscal year.

The river and harbor act of June 13, 1902, placed this improvement under the continuous contract system, appropriating $75,000 for the work, and authorizing the Secretary of War to enter into such contracts as may be necessary to complete the project, to be paid for out of such appropriations as may from time to time be made by law, not to exceed in the aggregate $227,083. This act also provided that the existing project may be so modified that the breakwater now under construction shall terminate at Cat Ledge; and that the remainder of the funds authorized to be expended by said act and not required for construction of the breakwater shall be applied toward the removal of "Round Rock," in Gloucester harbor.

Beverly Harbor.

This is new work, so far as improvement of the harbor by the United States is concerned. From the survey made in 1900 it was found that the harbor has an available channel of 18 feet at mean low water to the wharves of the town, but that the channel was somewhat contracted at certain points.

By the river and harbor act of June 13, 1902, Congress adopted a project for widening the present channel in its narrow places so as to give a clear width of 200 feet, and appropriated $10,000 for doing the work.

No work was in progress during the fiscal year on any of the other Massachusetts works in my charge.

Very respectfully, HARRY TAYLOR,
Captain, Corps of Engineers.

Statement of Maj. Geo. W. Goethals, Corps of Engineers, showing work done by the United States on the rivers and harbors in Massachusetts under the Newport, R. I., engineer office, during the fiscal year ending June 30, 1902: —

Hyannis Harbor.

No operations have been in progress during the past fiscal year. This project contemplates the dredging of an area of 36 acres protected by the breakwater to a depth of 15.5 feet. Of this area, about 26.6 acres have been dredged and two cuts 25 feet wide each and 13 feet deep have been dredged in to the wharf of the New York, New Haven & Hartford Railroad Company.

The river and harbor act of June 13, 1902, appropriated $35,000 for continuing the improvements at Hyannis and Nantucket, Mass.; of this amount, $20,000 has been allotted to Hyannis and $15,000 to Nantucket. The work of dredging will be continued during the coming year.

Nantucket Harbor.

No operations have been in progress during the past fiscal year. The project for this harbor contemplates the construction of two jetties as training walls, one on each side of the harbor entrance, planned so as to allow the tidal currents to assist in scouring out and maintaining a good channel, and for the completion of the work by dredging when necessary to obtain a depth of from 12 to 15 feet at low water in this channel. The west jetty has been built for a distance of 4,955 feet and the east jetty 4,840 feet from the initial points on shore. Portions of both jetties are still to be built up to their projected cross-sections. Of the $15,000 allotted from the appropriation of June 13, 1902, $7,000 will be used in dredging a 10 foot channel across the bar at the entrance to the channel, and the balance in making a survey and building up a gap in the east jetty near the shore end.

Vineyard Haven.

No operations have been in progress during the past fiscal year. In the river and harbor act of June 13, 1902, Congress authorized a general investigation of the subject of harbors of refuge for Vineyard and Nantucket sounds, with a view to determining the best location or locations for such harbors.

Woods Hole Channel.

No operations have been in progress during the past fiscal year. The existing jetty provides for deepening the channel through the strait to 13 feet at mean low water, and widening the same to 300 feet. There is now a fairly good channel of one-half the projected width, 150 feet, and 13 feet depth through the strait.

The appropriation of $20,000 for this work, made by the act of June 13, 1902, will be expended in completing the southern half of the channel and widening it to the northward.

New Bedford Harbor.

No operations have been in progress during the past fiscal year. The projected channels 18 feet deep extending from the deep water of Buzzards Bay to New Bedford and through the new drawbridge have been completed; and the appropriation of June 13, 1902, of $37,700 is for the completion of the anchorage area and some work in cleaning out the draw channel, which will complete all present approved projects.

Taunton River.

No operations have been in progress during the past fiscal year. The existing project contemplates dredging a channel so that it shall have a width of 100 feet and depth of 12 feet from the mouth of the river up to Berkley bridge; thence 12 feet depth and 80 feet width up to Briggs Shoal; thence 11 feet depth with the same width to the ship yard; thence 11 feet depth and 60 feet width up to Weir bridge, the depths all being referred to mean high water. This project is essentially completed, but there are a few points at which the channel requires widening. The appropriation of $5,000 made by the act of June 13, 1902, will be expended in widening the channel at points below Berkley bridge.

Fall River Harbor and Mount Hope Bay.

No operations have been in progress during the last fiscal year. Under the provisions of the river and harbor act of June 13, 1902, the project for the improvement of this harbor was enlarged so as to include dredging a channel 300 feet wide and 25 feet deep at mean low water across the flats in Mount Hope Bay to the deep water north-west of Common Fence Light, the northern point of the island of Rhode Island. Work under this project will be prosecuted during the coming year.

Removal of Wrecks.

During the fiscal year the following wrecks were removed so as no longer to form obstructions to navigation: the schooner "Electa Bailey," from Harding's Beach, Chatham, Mass.; and the "John Cullana" and "Alfred W. Fiske," from the Stone Horse Shoal off Monomoy Point, Cape Cod.

Taunton River and Boston Harbor Canal.

In accordance with the provisions of chapter 82 of the Resolves of 1902, the Board forwarded to each member of the General Court and to each Representative and Senator from Massachusetts in the Congress of the United States, a copy of the report of the Board relating to its survey of the proposed canal from Taunton River to Weymouth Fore River.

Harbor Compensation Fund.

There was paid into the treasury of the Commonwealth during the year, under sections 14 and 16 of chapter 19, Public Statutes, chapter 146, Acts of 1897, and chapter 96 of the Revised Laws, for tide water displaced by work done under licenses granted by the Board, and for rights and privileges granted in tide waters and great ponds, the sum of $32,036.42, which was credited to the harbor compensation fund for Boston harbor. The amount in this fund on Nov. 30, 1902, was $389,901.08; the balance of income from this fund in the treasury on the same date was $2,349.51: the total income for the year was $17,341.62.

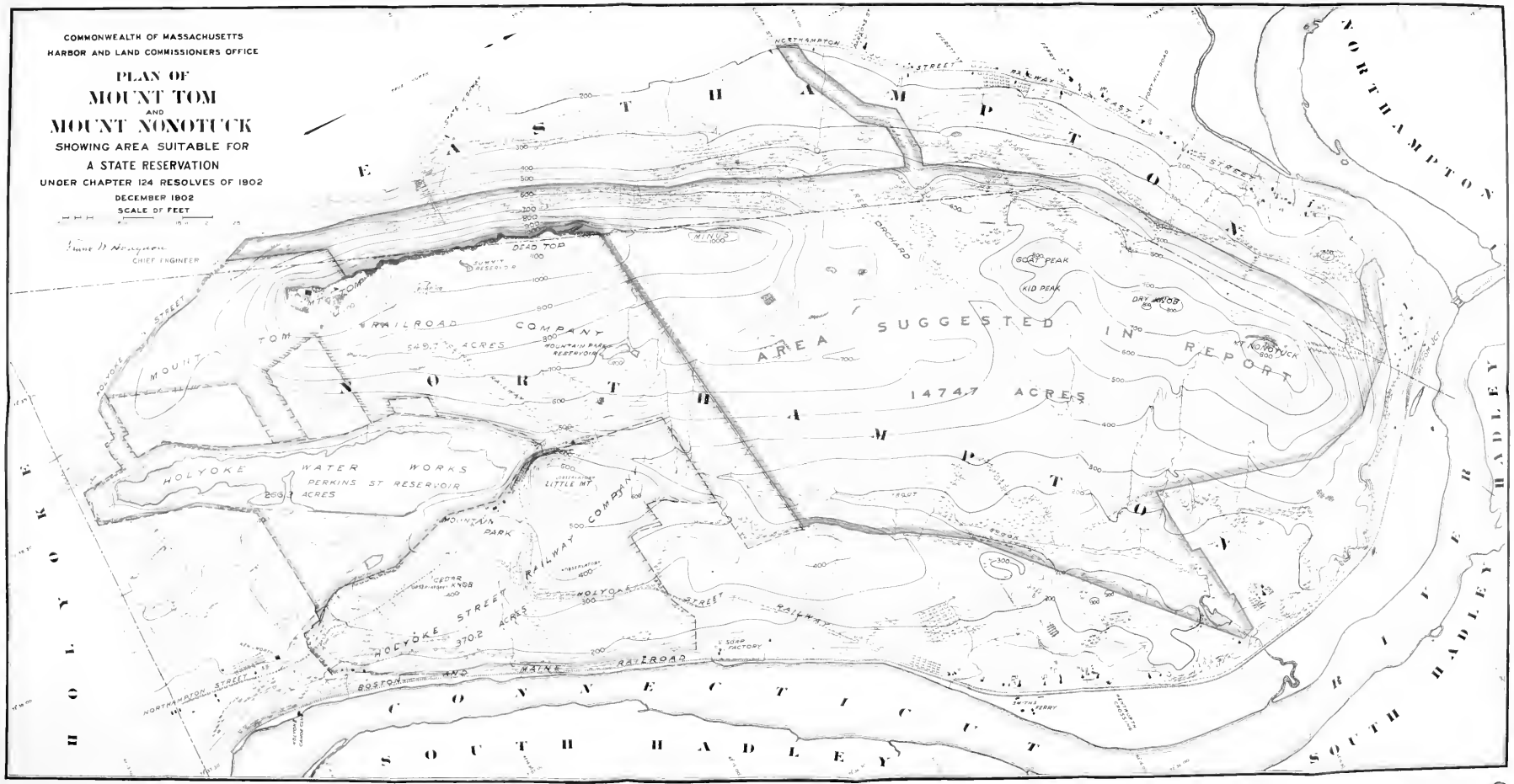
Commonwealth's Flats Improvement Fund.

The balance in the Commonwealth's flats improvement fund on the first day of December, 1901, was $605,296.25. To this has been added during the year $14,644.44 from the income of the fund and $1,019,531.96 from sales and rents of lands and other sources, making a total of $1,639,472.65. Of this sum there has been expended during the year $123,109.70, leaving a balance on Nov. 30, 1902, of $1,516,362.95.

The foregoing report is respectfully submitted.

WOODWARD EMERY,
CHARLES C. DOTEN,
GEORGE E. SMITH,
Commissioners.

Dec. 1, 1902.


COMMONWEALTH OF MASSACHUSETTS
HARBOR AND LAND COMMISSIONERS OFFICE
PLAN OF
MOUNT TOM
AND
MOUNT NONOTUCK
SHOWING AREA SUITABLE FOR
A STATE RESERVATION
UNDER CHAPTER 124 RESOLVES OF 1902
DECEMBER 1902
SCALE OF FEET
CHIEF ENGINEER
NORTHAMPTON
EASTHAMPTON
NORTHAMPTON
HOLYOKE
SOUTH HADLEY
CONNECTICUT
AREA SUGGESTED IN REPORT
14747 ACRES
MOUNT TOM RAILROAD COMPANY
549.7 ACRES
HOLYOKE WATER WORKS
PERKINS ST RESERVOIR
26.3 ACRES
MOUNTAIN PARK RESERVOIR
HOLYOKE STREET RAILWAY COMPANY
HOLYOKE STREET
370.2 ACRES
BOSTON AND MAINE RAILROAD
DEAD TOP
MT TOM
LITTLE MT
MOUNTAIN PARK
CEDAR KNOB
GOAT PEAK
KID PEAK
DRY KNOB
MT NONOTUCK
SOAP FACTORY
FERRY
NORTHAMPTON STREET
HOLYOKE STREET RAILWAY
EASTHAMPTON RAILWAY
MINUS
TROUT
FREE ORCHARD

APPENDIX.

APPENDIX.

[A.]

[See page 4 of this report, *ante*.]

CONTRACTS.

The contracts entered into during the year are as follows: —

1902.			
March 25.	With Lawler Brothers, for building sea wall and jetties at Stony Beach, in Hull, for the sum of $4.90 for each lineal foot of completed sea wall 8 feet high, $3.50 for each lineal foot of completed sea wall 6 feet high, and $2.50 for each lineal foot of completed spur jetty, — amounting to		$7,854 92
April 14.	With the New England Dredging Company, for dredging in Boston harbor, near Fiske's wharf, for the sum of 29½ cents for each cubic yard of material, measured in scows, — amounting to about		29,000 00
April 17.	With Ward & Cummings, for building a concrete sea wall at North Scituate beach, for the sum of $4.09 per lineal foot, — amounting to		6,130 50
May 9.	With Seymour & Newell, for building a dike on the Connecticut River, at Hadley, — amounting to		1,460 00
June 26.	With the New England Dredging Company and the Eastern Dredging Company, for dredging section 1 of the anchorage basin in Boston harbor, for the sum of $16\frac{3}{10}$ cents for each cubic yard of material, measured in scows, dredged and deposited at sea; $19\frac{3}{10}$ cents for each cubic yard of material, measured in scows, dredged and deposited on the Commonwealth flats, at South Boston; and $18\frac{5}{10}$ cents for each cubic yard of material, measured in the fill, rehandled and graded on the Commonwealth flats, at South Boston, — amounting to about		202,000 00

1902.			
June	26.	With Geo. H. Breymann & Brothers, for dredging section 2 of the anchorage basin in Boston harbor, for the sum of 15 cents for each cubic yard of material, measured in scows, — amounting to about	$97,740 00
June	26.	With Geo. H. Breymann & Brothers, for dredging section 3 of the anchorage basin in Boston harbor, for the sum of 15½ cents for each cubic yard of material, measured in scows, — amounting to about	100,238 50
June	26.	With Geo. H. Breymann & Brothers, for dredging section 4 of the anchorage basin in Boston harbor, for the sum of 16 cents for each cubic yard of material, measured in scows, — amounting to about	104,688 00
July	3.	With the J. S. Packard Dredging Company, for dredging at wharf of the Boston Molasses Company on the Commonwealth flats, at South Boston, for the sum of 14⅞ cents for each cubic yard of material, measured in scows, — amounting to	10,845 04
July	9.	With John C. Cobb, for dredging a channel in South Bay, Boston harbor, for the sum of 23 cents for each cubic yard of material, measured in scows, — amounting to about . . .	32,200 00
July	10.	With George Hayes & Co., for building a pile wharf on the Commonwealth flats, at South Boston, — amounting to	11,500 00
July	31.	With Eugene S. Belden & Sons, for building a stone breakwater in Apponagansett harbor, for the sum of $1.07 for each ton of stone placed in the work, — amounting to about .	30,000 00
August	8.	With John H. Gerrish, for dredging in West Bay, Osterville, for the sum of 32 cents for each cubic yard of material, measured in scows, — amounting to about	6,720 00
Sept.	4.	With Thomas H. Kiely, for furnishing riprap stone on the bank of the Connecticut River, at Hadley, for the sum of $1.67 for each cubic yard of stone delivered, — amounting to .	1,547 84
Sept.	4.	With Jones & Meehan, for paving street and building drains on the Commonwealth flats, at South Boston, — amounting to about . .	5,724 00
Sept.	8.	With John H. Gerrish, for dredging a portion of Lake Anthony, at Cottage City, for the sum of $70 per day, — amounting to . . .	2,030 00
Oct.	27.	With the New England Dredging Company and the Eastern Dredging Company, modification of contract of June 26, 1902.	

1902.				
Oct.	29.	With the New England Dredging Company and the Eastern Dredging Company, for dredging in Dorchester Bay, for the sum of 21 cents for each cubic yard of material, measured in scows, — amounting to		$11,760 00
		Total, about		$661,438 80

[B.]

[See page 34 of this report, *ante*.]

REPORT OF ENGINEER IN CHARGE OF CONNECTICUT RIVER WORK.

To the Honorable Board of Harbor and Land Commissioners of Massachusetts, WOODWARD EMERY, Esq., *Chairman*.

GENTLEMEN: — Since my report of Nov. 9, 1901, relating to the protective work done that year on the easterly bank of the Connecticut River in the town of Hadley, under the provisions of chapter 94 of the Resolves of 1901, the following matters have been attended to and work done: —

Agawam Trespass.

In January last I was notified that parties, abutters on the Connecticut River in Agawam, without authority from your Board, were cutting the willows on the protective works put in there several years ago. The matter was referred to your Board, and following your instructions I laid the matter before District Attorney John F. Noxon of Pittsfield. Following his advice and with your approval, I personally notified all parties having lands abutting on the river and against the State protective works in Agawam to refrain from further trespassing or interfering with the State's work without consent of your Board. Since notifying them I have not learned of any further interference with the work.

The expenses incurred in this matter were $27.96.

Setting Willows.

Willows were set last spring in the work done on the river bank in Hadley in 1901, and they have made a fair growth the past summer. The willows for this were mostly cut on the Agawam work, the supply furnished on the Hadley banks by former settings having been nearly exhausted in covering the work done in 1900.

The total expense of this work, including some slight repairs on a surface drain connected with the work of 1901, was $385.36.

Hadley Dike.

The dike below the highway bridge, between Northampton and Hadley, suggested in my report of 1901, has been built the past summer, substantially as arranged with your Mr. Hodgdon, and on land known as the Townsend lot, secured by the town of Hadley for this purpose without expense to the State. This dike is of earth, and extends from the highway leading from Northampton to Hadley to a point near the river bank, below the break made by the spring freshets of last year, a distance of 1,093½ feet. The crest of the dike is 8 feet wide, with side slopes of 2½ to 1. The material for the dike was thoroughly rolled every 6 inches in thickness as it was put in place. After completion the slopes and crest were seeded with rye and several varieties of grass seed, which have made a good growth during the summer and fall.

The contract for building the dike was awarded May 9, 1902, by your Board to Messrs. Seymour & Newell of Springfield, for $1,460, and they completed the work in a satisfactory manner and within the time limit mentioned in the specification.

The total cost of the work, including preliminary surveys, advertising, superintending, seed, etc., was $1,731.54.

Riprap Work.

The river bank, against the dike, extending from the break in the bank, below the highway bridge above referred to, for a distance of 500 feet down stream, has been protected with mat work and riprap in the same manner as other work of this kind in Hadley in past years, and fully described in former reports.

This work does not extend below the low-water line, like that done in former years, the gradual slope in the bed of the river from low-water mark outward seeming to render this part of the work unnecessary at this place.

This protective work has been carried around the sharp point in the line of the river bank, caused by the break above referred to, and for some distance into the excavation made in the meadow for filling on the State highway several years ago.

The contract for furnishing the stone for this work was awarded by your Board to Thomas H. Kiely of Northampton, for $1.67 per cubic yard of 4,500 pounds each. Mr. Kiely has carried out the provisions of his contract in a satisfactory manner, with the exception of a slight delay at one time in the delivery of stone, caused by heavy rains and bad condition of roads.

The number of yards delivered was 926.85; at $1.67 per yard, is $1,547.84.

Local help was employed, as in previous years, in laying the mats and riprap.

The total cost of this part of the work, including surveys, material (aside from stone), labor and superintending, was $1,108.22; which, with the cost of stone delivered, makes the total cost of the protective work on the river bank for this season, exclusive of the dike and setting willows, $2,656.06.

The area covered by the above work is 5,122 square yards, costing 51.85 cents per yard. There is yet some stone, already delivered, to be placed at the foot of the slope on the riprap, and this work will be attended to as soon as the river falls sufficiently to allow it to be done.

Respectfully submitted,

E. C. DAVIS.

Northampton, Mass., Nov. 28, 1902.

[C.]

[See page 47 of this report, *ante*.]

REPORT OF THE SUPERINTENDENT, PROVINCE LANDS.

PROVINCETOWN, MASS., Nov. 20, 1902.

To the Board of Harbor and Land Commissioners.

GENTLEMEN: — As superintendent of the Province Lands, I respectfully submit my annual report of operations on the lands for the year ending with November, 1902.

The work has been carried on practically upon the same lines as in the several years past, consisting of care of the roadways, the transplanting of maram or beach grass (*Ammophila Arenaria*), bayberry (*Myrica cerifera*) and other shrubs.

Work was not begun until about the first of July, too late in the season for spring planting of shrubs, seed or grass; so our first attention was given to necessary repairs on the road leading across the lands, and which has been constantly used since its completion in the spring of 1901.

The work of transplanting beach grass and bayberry began about the middle of September, and continued, as weather permitted, until the middle of November, commencing on the second range of sand dunes, where suspended in the fall of 1901, and extending easterly along the slope of the range, a distance of about 2,000 feet, and covering a surface of about 20 acres.

We have made a more extensive use of the bayberry this season than heretofore, as the good results obtained seemed to warrant. Although we make slower progress in covering the surface than by the use of grass alone, it gives more permanent results, especially along the top of the slopes.

The work upon the lands shows gradual improvement, and the trees and shrubs, some of which are naturally of slow growth, are healthy and vigorous.

The roadway across the lands with terminus near the Race Point life-saving station, completed in June, 1901, is in good condition.

It has been a great convenience to townspeople, and is highly appreciated by the many summer visitors.

Since the beginning of the work of reclaiming the Province Lands, in the spring of 1894, which work was largely experimental, several kinds of trees, shrubs and plants have been tried, with varied results. The following may be mentioned, and value of each estimated: —

Willows of Various Kinds. — None have proved of value, a small proportion living, but making no perceptible growth.

Silver Poplars (*Populus alba*). — Not of sufficient value to warrant use.

Tamarix (*Gallica*). — Of no value; not adapted to the soil.

Scotch Broom (*Genista scoparia*). — Has given fairly good results, but is liable to winter-kill, and does not propagate from its own seed, owing to the dryness of the surface of the ground. The only way it can be of use is by transplanting young plants which have been started in better soil.

Common Alder (*Alnus communis*). — Makes good growth; stands climate well; only used by transplanting, not being able to get good results from seed.

European White Birch (*Betula alba*). — Will live, but too slow growth.

Hornbeam (*Corpinus betulus*). — Of no value.

Cocksspur Thorn (*Crataegus Crus-Galli*). — Of no value.

Common Privet (*Ligustrum vulgare*). — Of no value.

Silver Maple (*Acer dasycarpum*). — Not of sufficient value to warrant its use.

Black Locust (*Robinia pseudacacia*). — It seems of considerable value; makes good growth; to be obtained from plants; not able to get results from seed.

Juniper (*Juniperus communis*). — Of no value; does not thrive.

Tree of Paradise (*Alanthus glandulosa*). — Easily raised from seed, but not adapted to soil; of no value.

Bayberry (*Myrica cerifera*). — Easily transplanted; spreads over the surface, and valuable for the work; unable to raise it from seed.

Native Pitch Pine (*Pinus rigida*). — Valuable and reliable; bears transplanting well, and does well from seed.

Austrian Pine (*Pinus Austriaca*). — Easily raised from seed, and bears transplanting; is doing well.

Scotch Pine (*Pinus sylvestris*). — Of good value; easily transplanted, and does well from seed.

White Pine (*Pinus strobus*). — Does not seem to be adapted to soil or climate; makes very slow growth.

Seaside Pine (*Pinus maritima*). — Starts easily from seed, but will not bear transplanting; makes quick growth for first two or three years, then liable to die out; not to be depended upon.

Of the above-mentioned trees and shrubs, the following we consider of much value for the work, and think can be depended upon: native pitch pine, Scotch pine, Austrian pine, common alder, black locust, bayberry and Scotch broom.

Respectfully submitted,

JAMES A. SMALL,
Superintendent of the Province Lands.

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Commissioners' Report.

Appendix.